UNITED NATIONS EDUCATIONAL SCIENTIFIC AND CULTURAL ORGANISATION
INTERNATIONAL BUREAU OF EDUCATION — PUBLICATION No 121

XIIIth INTERNATIONAL CONFERENCE
ON PUBLIC EDUCATION
CONVENED BY UNESCO AND THE I.B.E.

GENEVA 1950

STATE INSTITUTE OF EDUCATION
Govt. of West Bengal

INTRODUCTION TO MATHEMATICS IN PRIMARY SCHOOLS

FROM INFORMATION SUPPLIED
BY THE MINISTRIES OF EDUCATION

Afghanistan, Argentina, Australia, Austria, Belgium, Bolivia, Bulgaria, Canada, Chile, Colombia, Czechoslovakia, Denmark, Dominican Republic, Ecuador, Finland, France, Haiti, Holland, Hungary, Iceland, India, Ireland, Italy, Korea, Lebanon, Luxemburg, New Zealand, Nicaragua, Norway, Pakistan, Persia, Peru, Philippines, Poland, Portugal, Salvador, Sweden, Switzerland, Syria, Thailand, Turkey, Union of South Africa, United Kingdom, Uruguay, Venezuela, Yugoslavia.

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FOREWORD

The present study is one of a series of inquiries into subjects taught in primary schools.

Its data derive from replies sent by the various Ministries of Education, covering the teaching of arithmetic, geometry, and weights and measures. Consideration is given to the importance and role of this teaching, syllabus gradation and sequence, the methods teachers are advised to use, textbooks and teaching materials, and the direction of recent or prospective reforms.

The International Bureau of Education proposes to publish two supplementary studies on the same subject. One will be by Professor Piaget, showing which of the recognised aspects of a child's intellectual development merit most emphasis, in any endeavour to improve the teaching of mathematics. The second will deal with methods of teaching certain specific items in the mathematics syllabus.

Deep gratitude is expressed to the Ministries of Education of the forty-six countries replying to the International Bureau of Education questionnaire and sending documents of great interest, and to all those who have assisted and collaborated in the work.

Robert A. Mallet

Research Division
International Bureau of Education

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QUESTIONNAIRE ADRESSED TO THE MINISTRIES OF EDUCATION

I. THE PLACE OF THE RUDIMENTS OF MATHEMATICS IN THE CURRICULUM

1. At what age and in what classes of the nursery, infant or primary schools, does the teaching of arithmetic begin ?

2. How many periods a week are devoted to arithmetic and to the rudiments of mathematics in each class in the primary schools ?

3. What is such instruction called ?

4. Is geometry a separate subject in the primary schools ?
If so, at what age does it begin ? If not, is geometry as such referred to in the arithmetic lessons ?

II. CURRICULA

5. What in brief are the matters dealt with under the headings of arithmetic and rudiments of mathematics in each class in the primary schools ?

6. What importance is given to practical work ?

7. Is any attempt made to introduce children to mathematics incidentally, in connection with other subjects ?
If so, give some examples.

8. What importance is attached to mathematics in the yearly and (primary) leaving examinations ?

III. AIM OF INSTRUCTION

9. What are the official instructions or suggestions concerning the aim of teaching arithmetic and the rudiments of mathematics in the nursery, infant and primary schools ?

IV. METHODS

10. Do official suggestions exist concerning the teaching of these subjects ? If so, what is their nature ?
If not, what are the methods mosts commonly employed at the various levels of primary education ?

11. What aids to teaching are used ?

12. At what level of the nursery and infant schools (or even of the lower classes of the primary schools), are mathematics introduced through activities based on educational games ?

13. Do the official instructions require the use of text-books and printed exercises ? If so, how are these books chosen, prepared, and adapted to the age and environment of the children ?

14. Where activity methods take the place of text-books, what is done to compensate for the lack of books ?

V. MISCELLANEOUS

15. Have any modifications been introduced recently in the teaching of arithmetic and the rudiments of mathematics, or are they contemplated for the near future ?

16. What are the most recent works published in your country on the teaching of mathematics in primary schools ?

17. What further information related to the subject can you offer ?

18. If possible, kindly add to your reply a selection of the textbooks used in your country for teaching arithmetic and the rudiments of mathematics, together with any documents of special interest. Any material sent will be placed in the Exhibition or the Library of the International Bureau of Education.

GENERAL SURVEY

PLACE OF MATHEMATICS IN THE CURRICULUM

Beginning Mathematics

To introduce children to mathematics is one of the essential tasks of the primary school. Out of the seventy-six national or provincial authorities who have kindly sent replies to the present inquiry, no fewer than seventy-five have primary schools in which an introduction to mathematics is given from the first class onwards, from the age, that is to say, of six or seven years. The subject is begun, moreover, in the one country departing somewhat from the rule, only one year later, in the second class.

It is of interest to note, further, how many of these countries endeavour to give children some notions of mathematics before they enter the primary school. The tendency is, in fact, to give a first introduction to the subject in the nursery, infant or preparatory classes attended by children of five to six years of age. Such classes are specifically referred to in the replies from Australia, British Columbia in Canada, Chile, France, Haiti, Holland, Ireland, New Zealand, Peru, the cantons of Geneva and Vaud in Switzerland, the Union of South Africa, and Venezuela. In India and Pakistan, it is the primary school itself which tends to cater for children of this age.

At the level of children of five or six years old, what may be called introduction to mathematics generally consists of little more than certain quantitative experiences enabling them to form some idea of number and use it within the range of one to ten. Sometimes such children learn to count, however, up to twenty or thirty, and in India, Pakistan and the Union of South Africa, may go still further and learn written numeration up to twenty or even a hundred, and multiplication tables.

In some cases children of no more than four years old have opportunity in pre-school establishments to gain some notions of quantity, as in Colombia, Ecuador, Italy, Pakistan and Uruguay, or even of no more than three years old, as in Belgium, Bulgaria, Ontario in Canada, Scotland, Lebanon, Persia, Syria, Thailand and Yugoslavia. At this level children mainly gain a vocabulary in an *ad hoc* way, leading to a notion of number, by comparing lengths, thicknesses, quantities and so on.

TIME GIVEN TO MATHEMATICS

On analysing the data contained in the national reports following this general survey, it appears that, with the exception of Australia, Canada, New Zealand, Thailand and the Union of South Africa, an average of four to six hours a week is given to an introduction to mathematics in the primary school, and that the amount of time spent on the subject is usually divided equally for each school day.

Lessons given in the first two or three classes are also generally a little shorter or less numerous than in later classes. There are, however, exceptions to this rule; in Argentina and Yugoslavia, for example, six hours a week are devoted to mathematics in the first two classes and only five hours in succeeding classes, and in the canton of Geneva in Switzerland five hours in the first three classes and only four hours in the remaining classes.

It is also to be noted that in Afghanistan, the cantons of Neuchâtel and Vaud in Switzerland, and certain districts in England, girls devote less time to mathematics than boys.

Of the five countries mentioned above as being exceptions as regards the general average of time devoted to mathematics, four—namely, Australia, New Zealand, Thailand and the Union of South Africa—give an average of three to four hours a week to the subject (this amount of time being divided in Australia into six to nine periods). The remaining country—namely, Canada—gives no more than an average of about two hours a week to mathematics at primary level. None of these five countries, incidentally, uses the metric system of weights and measures, a fact which one would have thought called for more rather than less work in mathematics.

In Haiti the official primary time-tables allot two to three hours a week for mathematics, but this amount is generally considered quite insufficient and in practice is increased to five hours.

In several countries, as for example England, Ontario in Canada, Italy and New Zealand, within certain limits teachers can arrange their time-table as they wish, no hard-and-fast allocations of time being officially made for each subject. In Finland the directors of schools set up the time-tables, an arrangement allowing for continuity throughout the school and adaptation to local conditions.

NAME GIVEN TO THE SUBJECT

In all the countries that have replied to the International Bureau of Education's questionnaire, introduction to mathematics is taught as a separate subject, with additions in certain cases in the form of lessons of an incidental kind.

In many of the official primary curricula, the name given to the subject consists of one single, simple word with the meaning of " reckoning " or " number ". Such is the case, for example, in Denmark *(Regning)*, France *(Calcul)*, Holland *(Rekenonderwijs)*, Iceland *(Reikningur)*, Korea *(Sembon)*, Lebanon, Luxemburg *(Rechnen)*, Norway *(Regning)*, Peru *(Cálculo)*, and Basel-City in Switzerland *(Rechnen)*. In Haiti such a word is used for all sections of the primary school, except the preparatory section, where the subject is called an introduction.

Each single, simple word of this kind well expresses the salient characteristics of mathematics as taught at primary level. The authorities in some countries, however, find it too limited in scope and couple it with another term meaning " geometry ". Such is the practice in, for example, Afghanistan, Austria *(Rechnen und Raumlehre)*, Czechoslovakia, Finland, Sweden *(Räkning och Geometri)* and Yugoslavia. With even greater nicety Ecuador uses three terms (*Cálculo, Medida y Forma*—number, measurement and form) ; Hungary employs a double term meaning " number and measurement ".

Elsewhere a term is used that has a more scientific (and yet in some ways more limited) ring than the simple words for " number " or " reckoning ". The term *Arithmétique*—as opposed to *Calcul*—is extensively used, for example, in certain French-speaking countries, in particular in the Catholic parts of Quebec in Canada, and in Geneva and Neuchâtel in Switzerland, and *Aritmética* in Portugal.

This more sophisticated term may also be deemed insufficient and coupled with a word meaning " geometry ". Such is the case in Bolivia, Nicaragua and Uruguay *(Aritmética y Geometría)*, Italy and Persia. To two such terms the canton of Vaud in Switzerland adds a third—*Comptabilité* (bookkeeping).

In yet other countries a still more developed term is used, meaning or being the direct equivalent of " mathematics ". Such is the case in Australia and Ireland (the word *Number*, however, being used for the lower classes, as noted below), Argentina, Chile, the Dominican Republic and Salvador *(Matemáticas)*, Poland *(Matematyka)*, Turkey, Saskatchewan in Canada, and Kutch in India.

There is a tendency, in many countries, moreover, to use a simple term for the subject in lower primary classes and a more advanced one in higher classes. Such is the custom, for instance, in Australia, Ireland, New Zealand, the United Kingdom and most provinces in Canada *(Number*, followed by *Arithmetic* or *Mathematics)*, Pakistan, Thailand, Belgium *(Pré-calcul* or *Initiation au Calcul*, followed by *Arithmétique)*, and Syria.

The term *Arithmetic*, as used in an English-speaking country, refers rather to a subject of a preliminary or introductory nature, and in French thus corresponds more to *Calcul* than to *Arithmétique*. In connection with the whole question of terminology, the reply covering England and Wales states : " There is a growing movement to think of the work as elementary mathematics, though this has not yet affected the nomenclature. "

Role of Geometry

The variety of terms employed to designate the subject of mathematics at primary level is perhaps due to a certain imprecision in the use of words, and this imprecision again makes itself felt in connection with the question of the part geometry plays in the subject. In some countries, calculating areas, for example, is considered to be part of geometry, whereas in others it is looked on as part of arithmetic. Such differences of approach must therefore be taken into account in interpreting the replies given in this connection.

Calculating areas and volumes appears, usually in the third and fourth year, in all the primary syllabuses, but not as a separate subject, and in some cases represents the limits of the geometry taught. In other countries, on the other hand, certain work with forms is done from the first year onwards or even in the nursery-infant school.

To begin with countries in which geometry appears comparatively early, the forming of a child's ideas of space begins in Austria (where mathematics is introduced under the heading of *Rechnen und Raumlehre*) with activities involving handling, showing, removing, folding, modelling and cutting out, and in the third year with describing planes and volumes. In Finland geometrical work is limited in the lower classes to learning a certain vocabulary (horizontal, vertical, square, triangle, circle, cube and so on), mainly in study of surroundings and drawing lessons. In Czechoslovakia the study of geometrical forms begins in the second class. In Yugoslavia measurements are studied from the first year onwards. Forming concepts of shapes (squares, rectangles, triangles, cubes and spheres) comes in the first class in Ecuador, under the heading of the subject called *Cálculo, Medida y Forma*, although geometry as such first appears only in the third class, when studies become more systematic. In Hungary geometrical notions are given in the first class in the course of lessons on " measurement ".

As examples of procedure in countries using a term meaning " mathematics " for the subject as a whole, may be cited Argentina, Chile, Colombia, the Philippines and Salvador, where work with forms begins in the first class. The basis of such work in Poland consists of certain exercises beginning in the second class of pre-school education. In Turkey first notions of geometry are acquired in the lower classes in the course of lessons on *Hayat Bilgisi* (knowledge of life). In Venezuela measuring appears in the first year of the syllabus of *Cálculo y Matemáticas Elementales.*

Geometrical notions are given from the first class on wards also in Belgium, France, Norway, Peru, and Basel-City in Switzerland.

In Belgium concepts of geometrical forms, in close correlation with notions of number and measurement, form an integral part of the teaching on mathematics in all classes. The purpose of the sense-training given in the nursery-infant schools is to help a child distinguish form from colour, shape and material; from the age of six onwards he acquires a conception of form through a gradual process of abstraction.

In the canton of Neuchâtel in Switzerland, and Syria, the arithmetic syllabuses include an elementary study of certain geometrical figures from the second class onwards.

It is thus evident that work on geometrical forms frequently forms part of an introduction to mathematics right from the early stages of primary education, whatever name is given to the subject as a whole.

MATHEMATICS IN PRIMARY EXAMINATIONS

The importance attached to mathematics from the point of view of examinations would seem to depend on which of the three following examination procedures is in force :—

a) Certain subjects, including mathematics, are decisive.

b) Two or three subjects, including mathematics, while not being decisive, are regarded as the main subjects.

c) Equal importance is attached to all subjects.

As examples where procedure a) is in force may be cited :— Bolivia and parts of India (a child who fails in mathematics has to stay down for another year); Iceland and Italy (the mother tongue and mathematics are decisive); Sweden (the mother tongue and mathematics are decisive in the primary school leaving examination); Portugal (arithmetic comes second only to the mother tongue, and is decisive in the fourth year examination); Luxemburg (German and arithmetic are the two main subjects in the first two classes, French being added to them as from the third class; a child who does not obtain a satisfactory average of marks in class for these subjects, may have to stay down for another year); Bulgaria, Czechoslovakia and Yugoslavia (although the examination system has been abolished, promotion depends on a knowledge of the arithmetic covered by the syllabus).

As instances where procedure b) is in force, may be cited Argentina, Austria, Belgium, Colombia, England and Wales, Holland, certain parts of India and Pakistan, Korea, Peru and Syria; New Brunswick in Canada, Finland and Lebanon (mathematics come second only to the mother tongue); Haiti (French, national history and mathematics are the three main subjects); the Union of South Africa (arithmetic is one of three main subjects); Chile (the mother tongue, mathematics, natural science and social sciences, in that order).

The reply from the province of Sind in Pakistan gives the following three reasons for attaching great importance to mathematics in the yearly and primary school leaving examinations: i) it is recognised that arithmetic is taught because of its usefulness and the training it gives to the mind in reasoning and logical thinking; ii) the modern industrial system and the part played by science in a modern civilized community make great demands upon the mathematical knowledge of the ordinary citizen; and iii) it is recognised that arithmetical knowledge is indispensable for providing the necessary facility to a pupil in his after-school life.

Finally, as examples of countries where procedure c) is in force, may be cited Manitoba in Canada, Turkey and Venezuela.

In other cases, it is more difficult to estimate the precise value attached to mathematics in examinations. Written examinations in those countries where they exist, always include a paper on arithmetic, to which an oral test may be added.

AIMS

The general aims of teaching mathematics at primary level are given, more or less explicitly, in the majority of the curricula. They are roughly a) to give a child a useful tool, and b) to help him acquire a mental discipline. Such a classification, however, does not fully express the variety of the replies, and needs to be amplified.

For example, in presenting mathematics as a tool subject, emphasis may be put on the way in which the tool is used, and one of its aims is then to form habits of work. In other cases the stress may be more on the usefulness of the tool or the circumstances in which it will be used, and the purpose of teaching then becomes to inculcate a certain attitude towards life. Elsewhere importance may be attached to the way in which the tool is constructed, and the fundamental aim of the subject is then considered to be to impart knowledge or arouse interest.

As a means, moreover, of intellectual training, of imparting a mental discipline, mathematics may have a great variety of effects on the behaviour of the individuals to whom they are taught, and the subject now appears valuable and important for the contribution it can make to general education or even to education in its widest sense.

More precisely and less arbitrarily then, although still without doing justice to the plenitude of the replies on this point, the aims of mathematics in any given country may be subsumed under one or more of the following heads :—

i) acquiring a technique ;
ii) forming habits of work ;
iii) acquiring a mental attitude ;
iv) gaining knowledge and interest ;
v) training the intellect ;
vi) an educational factor.

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ACQUIRING A TECHNIQUE

The acquisition of a technique is evidently the first aim of an introduction to mathematics, being expressed in some way or another in almost all the curricula.

In Argentina, Italy, Lebanon, Luxemburg and Uruguay, this aim is expressed in quite general fashion : children are expected to acquire the knowledge they will need in everyday life.

Frequently the emphasis is placed on an ability to reckon. The principal aim of the subject is then, as in Geneva in Switzerland, to " develop a child's ability to count, which involves the acquisition of speed, confidence and mechanical skills " or, as in France, to " acquire the arithmetical skills, and learn to calculate quickly and accurately ", or again, as in Saskatchewan in Canada, " the acquisition of skills and the mastery of the fundamental processes ". This aspect of the subject has also been stressed in the replies from Austria, Belgium, Canada (British Columbia, Manitoba, New Brunswick, Nova Scotia, Prince Edward Island and Quebec), Denmark, the Dominican Republic, Hungary, India (Mysore), Ireland, New Zealand, Pakistan (Karachi and Sind), Persia, the Philippines, Poland, Switzerland (Basel-City, Neuchâtel and Zurich), Syria, Turkey, Union of South Africa (Natal), Venezuela and Yugoslavia.

Without necessarily insisting on the importance of the basic skills, a number of countries have stated that the aim of the mathematics syllabus is to enable children to solve simple everyday problems, or to equip them for practical life. Replies to this effect have been received from Afghanistan, Australia, Austria, Bolivia, Bulgaria, Canada (Manitoba, Nova Scotia, Prince Edward Island, Quebec and Saskatchewan), Denmark, Finland, France, Holland, Hungary, Iceland, Ireland, Korea, Pakistan (Baluchistan, Punjab and Sind), Peru, the Philippines, Portugal, Salvador, Sweden, Switzerland (Vaud and Zurich) and the United Kingdom. The reply from France says that in the top primary class, " with children who have not been selected for the secondary school, and who are completing their last years at school, before going out into life, teaching is directed to applying their knowledge to solving the everyday problems of the householder, farmer, worker or citizen. . ." In Bolivia, Ireland, and Canada (Nova Scotia and Saskatchewan), moreover, an introduction to mathematics is expected to contribute to children's training for social life and also, in the case of Nova Scotia, for "productive labour". In Colombia the aim of mathematics is " getting good results, through the application of formal ability to the quantitative aspects of everyday life ".

The particular skill that should be acquired is sometimes specified. In Haiti, for example, arithmetic should " give a child certain modest notions of bookkeeping, and enable him to make out a bill and calculate quickly and accurately ". In Natal in the Union of South Africa, the teaching of arithmetic should aim, in the first four primary classes, at giving a pupil " an ability to employ the operations with the money, weights and measures in daily use in his environment " and, at all levels, develop his ability to bring number to bear upon everyday problems and make him thoroughly familiar with the tables necessary for their solution. In Yugoslavia children should acquire the notions of geometry necessary for everyday life, and in Norway " useful ideas of quantity and space. " In Geneva in Switzerland, elementary geometry should enable a child to calculate length, area and volume, and to estimate, compare and measure. In Prince Edward Island in Canada a child should learn to use approximations and checks to test results.

Forming Habits of Work

It is obvious that the value of calculations depends on their absolute accuracy, which in turn is a function of disposition. It is therefore considered, in, for example, Czechoslovakia, Switzerland (Vaud), the Union of South Africa (Cape Province) and Yugoslavia, that one aim of an introduction to mathematics should be to train children to be orderly and precise.

In Czechoslovakia and Turkey the subject is also expected to give children habits of economy in work. In Pakistan (Sind) and the Union of South Africa (Cape Province), arithmetic should, without neglecting quality, train children in habits of speed. In the Protestant schools of Quebec in Canada, arithmetic lessons should cultivate habits of care, order and neatness.

ACQUIRING A MENTAL ATTITUDE

Possessing a tool and knowing how to use it in the classroom are not of themselves sufficient; they have also to be applied in real life. It is probably for this reason that arithmetic is expected to help a child " to understand the value of number in the ordinary affairs of life " (Ontario in Canada), to use arithmetical ideas in everyday situations (Manitoba and Quebec in Canada), or to turn to good account the skills required to solve everyday problems involving number (Australia, Norway, and New Brunswick, Prince Edward Island and Quebec in Canada).

In Chile the teaching of mathematics should aim at enabling a child to understand the quantitative aspects of his surroundings and react intelligently to the problems arising in individual or community life. The same tendency is found in Peru, Salvador, and Basel-City in Switzerland; in Austria spatial as well as quantitative aspects are included.

Elsewhere the subject is expected to give children an appreciation of the importance of numbers in life (New Zealand), an understanding of their value (Quebec in Canada), or an arithmetical sense (Manitoba in Canada, and Venezuela).

In British Columbia and New Brunswick in Canada, and Venezuela, special emphasis is laid on a child's learning to appreciate the social value of the subject. In Czechoslovakia it is expected to enable him " to grasp the value and problems of economic planning ".

In Natal in the Union of South Africa, arithmetic should aim at fostering " appreciation of economy of time and effort, and of how neatness of arrangement helps such economy " ; in Finland the same subject is considered " of use for developing certain abilities (reflection, estimating, taking care) ".

It is evident that such " understanding " and " appreciation " call for a certain knowledge whose acquisition forms an aim correlated with the one now being discussed.

GAINING KNOWLEDGE AND INTEREST

In some countries (Afghanistan, Ontario and Quebec in Canada, Iceland, and Natal in the Union of South Africa), mathematics at primary level are regarded as a basis for further study at a higher level, the emphasis thus being more on knowledge gained than on a power to apply.

The same emphasis perhaps lies behind the statement that one aim of an introduction to mathematics is to form clear ideas of the properties of number, time and space (Australia, New Brunswick in Canada, and England), or to build up numerical concepts (Zurich in Switzerland, Cape Province in the Union of South Africa, and Yugoslavia).

In the replies from Ontario in Canada, Poland, and Natal in the Union of South Africa, one aim of teaching mathematics at primary level is given as being to arouse a child's interest in number, and so facilitate his learning.

Training the Intellect

Another essential aim of an introduction to mathematics would appear to be intellectual training, mention of which is made in thirty-one of the seventy-six curricula analysed for the present general survey.

The way in which this aim is expressed, however, varies considerably. In Argentina, Bolivia, Bulgaria, Lebanon and Luxemburg, for example, it is said quite simply that the subject should contribute to a child's intellectual development, and some of these countries mention the particular faculty—reasoning, speed, memory, attention, reflection, and so on—that should be developed.

In Austria, Belgium, Bolivia, Colombia, France, Ireland, Peru, the Philippines, Portugal, Switzerland (Neuchâtel and Zurich), the Union of South Africa (Cape Province) and Yugoslavia, one important aim of the subject appears to be to make a child's thinking logical, cultivate his power to reason, and give him mental discipline. In " Notes for Teachers—Mathematics ", published by the Irish Department of Education, is it stated that the main aim of mathematics is not the acquisition of knowledge, but " training 'in the art of thinking—consecutively, closely, logically' " ; the Belgian primary curriculum seeks to " ensure a union between knowledge and intellectual training, a simultaneous 'in-forming' and 'forming' of a child's mind ".

The subject is expected, furthermore, " to develop children's ability to think and deal with life mathematically " (Korea), to develop in them a habit of thinking clearly (Venezuela), and to assist in forming their power to reflect and reason (Syria). In Canada (Newfoundland), Italy and Pakistan (Karachi), mathematics would appear to be valued because they sharpen a child's intellect and enable him to think quickly.

In the Protestant schools of Quebec in Canada, arithmetic is expected to " enable a pupil to think in terms of order, size, quantity and number ", and in Poland to prepare his mind for formal teaching. Hungary, Persia and Pakistan (Baluchistan) are perhaps pursuing a similar aim in demanding that the subject should develop a child's powers of reasoning and thinking in abstract terms. In Persia and Pakistan (Baluchistan), moreover, and also in Czechoslovakia and Switzerland (Vaud), mathematics is in addition expected to aid in forming judgment.

The curriculum for the Catholic primary schools of Quebec in Canada speaks of this aim in the following terms, which more or less give its essence in whatever country it is pursued :— " Arithmetical work well done develops attention, mental suppleness and speed, confidence and absolute accuracy. It calls for a true appreciation of facts and quantities, and teaches patience, self-control, and a sense of logical sequence and practical necessities. "

An Educational Factor

An introduction to mathematics, as has been seen above, may be expected to teach patience, self-control and a sense of logical sequence. It is therefore not surprising, although in actual fact the point is rarely made in the curricula, that it should be deemed of great educational value, capable of aiding in the development of such moral values as honesty, initiative and industry (the Protestant schools of Quebec in Canada), or of intellectual independence (Salvador).

SYLLABUSES

In this section comparison will be made of the stages reached in mathematics, in the various primary classes, with particular reference to i) whole numbers—numeration and notation, ii) addition and subtraction, iii) multiplication and division, iv) money, and weights and measures, v) decimals and fractions, and vi) geometry. Details will also be given of vii) the place of practical work, and of viii) the incidental teaching of mathematics.

It is necessary to bear in mind that the questionnaire sent out by the International Bureau of Education asked that the various points raised should be treated briefly, and many of the replies from the school authorities thus give little more than a summary of the syllabuses, while others are more complete in this respect. Differences have arisen which limit the validity of any comparisons made.

A further difficulty is that compulsory schooling does not begin everywhere at the same age, and may or may not be preceded by pre-school education. Children's natural rhythm of development, moreover, is not the same in all countries.

Taking these varying factors into account, it is clear that the most useful comparison possible is that of the syllabuses, year by year, of the primary schools proper, to which children generally first come at the age of six or seven. Wherever the boundary between nursery-infant and primary education is not clearly defined, it has nevertheless been assumed that primary schooling does in fact begin at about this age. On this basis it has proved feasible to reach certain general conclusions and to bring certain problems into relief.

WHOLE NUMBERS

The majority of syllabuses stipulate that children study the numbers up to 100 in the first primary year, 1,000 in the second, 10,000 in the third and 100,000 in the fourth, and that they begin to generalise in the fifth.

Such a tendency, however, cannot be said to be universal, for the number of countries is by no means negligible, in which the upper limit of the numbers studied is 20 in the first year, 100 in the second, 1,000 in the third and 1,000,000 in the fourth. It would then appear that generalisation of a sort begins already in the fourth year, for children, that is to say, of nine or ten years of age, or, in some cases, even earlier.

In Belgium, for example, the children in the second grade, who are from eight to ten years of age, have to learn, read and write the numbers up to 10,000 and prepare for work on the principles of numeration. In Canada (Nova Scotia), children in the fourth year must study numbers beyond 10,000. In Ireland, children do the numeration and notation of numbers up to 10,000 in the third year, and study the principles of numeration in the fourth. The general treatment of whole numbers would also seem to begin in the fourth year in Holland and, within practical limits, in Transvaal in the Union of South Africa (standard III).

Such general statements in regard to the treatment of whole numbers need in some respects to be amplified. In Australia (Queensland, South Australia and Western Australia), Canada (Alberta, Ontario and Saskatchewan), Ireland, Portugal and the Union of South Africa (Natal and the Orange Free State), for example, the upper limits given in the syllabuses are not invariably 100, 1,000, 10,000, etc., but sometimes these numbers less one and thus composed exclusively of 9's. Again, in Switzerland (Geneva), these limits are 10 in the first year, 120 in the second, 1,200 in the third, 200,000 in the fourth, and among the millions in the sixth.

Occasionally children are expected in the first year to learn numeration up to 100, but notation only to 10. Such is the case, for example, in Canada (New Brunswick and Ontario) and Venezuela. In Pakistan (Karachi) children in the first year do notation up to 20, and in Canada (Alberta) numeration up to 20 and notation up to 10. Yet again, in the Union of South Africa (Natal), written notation up to 9,999 appears in the first year, and is already up to 1,000,000 in the third.

It is, finally, of interest to note that in Canada (Ontario), children in the fifth year study the history of numeration and notation.

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ADDITION AND SUBTRACTION

One striking common feature emerges from a study of the treatment in the various replies of the basic operations: no mention is made of addition and subtraction tables, with the possible exception of three countries. It would not appear unreasonable to interpret this feature as arising because the word "table" often recalls a purely mnemonic method of learning, which ill accords with modern educational ideas.

It is to be noted, in fact, that, among the numerous addition and subtraction exercises (dealt with in detail below), the syllabuses speak of certain work on the " analysis and synthesis of numbers " or on " number facts." These two more or less equivalent expressions refer to exercises which may be done in concrete fashion before numbers as such are broached, and which may be regarded as the activity approach to learning addition and subtraction tables. Even so, any systematisation in regard to the " number facts " at too early a stage, is of itself enough to reduce considerably the distance between such an approach and old methods.

With a certain reserve, due to lack of full information in certain cases, it may be said that the general tendency is to give addition and subtraction exercises on numbers up to 10 in the first year, and up to 20 in the second, and to expect the learning will be completed in the third year, of what one is after all justified in calling " addition and subtraction tables."

The syllabuses, moreover, refer to another activity that may be deemed to assist children to learn their tables, namely counting. Counting numbers upwards or downwards is, in fact, learning to add or take away " 1 ", and similarly counting in two's or three's is in effect learning the tables for " 2 " and " 3 ". Such counting exercises, furthermore, constitute an introduction to multiplication tables.

Counting exercises of this kind appear in the first and second year syllabuses (only rarely in those for the third year) of Canada (Alberta, New Brunswick, Nova Scotia, Ontario, Prince Edward Island, Saskatchewan and Newfoundland), Italy, Pakistan (Sind), Persia, the Union of South Africa (Cape Province, Natal and Transvaal), Uruguay and Venezuela.

One might well conclude from the foregoing remarks that the boundary between learning " tables " and learning " operations " is not very clearly marked. This is in fact the case; the basic technique of the operations is for the most part learnt in the first three years, and perfected later, and, as with the study of the " tables ", there is a very close correlation between addition exercises and those on subtraction.

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Certain exceptions, however, need to be noted to this latter rule. In Hungary and India (Mysore), in particular, addition up to 20 is spoken of, but no mention is made of subtraction.

From the second year onwards, the upper limit of the numbers used for addition and subtraction tends to be the same as that of the numbers to be learnt. In the first year it tends rather to approximate to that (20 or 10) of the numbers used for tables; exercises on numbers up to 99 or 100, however, are given in Australia (Queensland), Bulgaria, Colombia, Ireland, Norway, Persia, Portugal, Salvador, Syria and the Union of South Africa (Cape Province—in Natal, addition at this stage goes as far as four three-digit numbers, and subtraction covers three-digit numbers).

It is also to be noted that learning to carry comes sometimes during the second year, sometimes during the third.

Some syllabuses give very precise instructions concerning the maximal difficulties that children should meet with in each year. Certain characteristic examples in this connection are worth noting. In New South Wales in Australia, the upper limits of numbers used for addition and subtraction must not exceed 10, 20 and 100 respectively for the first three years; in the fourth year children should learn to add seven one-digit numbers or four three-digit numbers, and in the fifth year up to ten one-digit numbers or five four-digit numbers; in the two latter classes the corresponding limits for subtraction are those of the numbers known, namely 100,000 and 1,000,000 respectively.

In Ontario in Canada, furthermore, addition and subtraction are done using numbers up to 10 in the first year; and addition using up to five one-digit numbers or three two-digit numbers, without carrying, in the second year; up to six one-digit numbers, four two-digit numbers with carrying, and three three-digit numbers, in the third year; and up to ten one-digit numbers, five two-digit numbers and four three-digit numbers in the fourth year. The maximal limits set for subtraction in the last three classes are similar—two-digit numbers without borrowing, in the second year, three-digit numbers with borrowing, in the third, and four-digit numbers in the fourth.

Multiplication and Division

As mentioned above, practically none of the replies make any reference to addition and subtraction tables. About half of them, on the other hand, refer to multiplication tables. They rarely speak of division tables.

The tendency appears to be to make a progressive study of multiplication tables in the first three or four years of primary schooling. In Australia (Victoria), Canada (Nova Scotia and Prince Edward

Island), Ecuador, Holland, Iceland and Italy, however, such work does not begin before the second or even the third year.

The upper limits of the tables seem to be to some extent determined by the base or bases used for the system of weights and measures. For making calculations with a system whose base is twelve, for example, it is naturally of importance to teach children up to the 12-times table ; in India and Pakistan, where the monetary unit is composed of sixteen annas, children must learn up to the 16-times table.

In Pakistan (North West Frontier Province), children have to learn tables up to 6×16 in the first year, 16×16 in the second, and 20×20 in the third, and then the $^{1}/_{4}$-, $1^{3}/_{4}$- and $1^{1}/_{2}$-times tables up to 16 in the fourth year. In Punjab they do up to 10×10 in the first year, and 16×16 in the second, and the syllabus also includes the $1^{1}/_{2}$-, $1^{3}/_{4}$- and $2^{1}/_{2}$-times tables.

In some countries, furthermore, children are given numerous exercises to help them learn their tables, in the first two years, but do not begin a systematic study of them before the second or third year.

Then, as far as the operations are concerned, it is clear, as one would expect, that learning to multiply and divide is an important point in the mathematics syllabuses. It appears that the main effort in this connection is made during the third year, at a time, in other words, when the children have already acquired a sufficient knowledge of their multiplication tables.

In a good many countries, however, a first introduction to multiplication and division is given in the first year, in concrete form. In Afghanistan, Italy, Nicaragua and Yugoslavia, for example, the four operations to to 20 are taken in this way from the first year onwards. Similarly, children in their first year learn to multiply quantities less than 20 by 2, 4 and 3 in Austria, by 2, 3 and 4 in Syria, and by numbers up to 5 in Lebanon. In Colombia, Portugal, Salvador and the Union of South Africa (Cape Province), exercises with the four operations on numbers up to 100 come in the first-year syllabus; in the Union of South Africa too, multiplication and division of three-digit numbers by 2, 3, 4, 5 and 6 are done in Natal, and multiplication and division with the aid of tables in the Orange Free State, during the first year.

In some cases multiplication and division are introduced by giving the children notions of double, triple, half, third, quarter, and so on. Such is the case in, for example, Argentina, Belgium, Ecuador and Uruguay.

In those countries where multiplication and division exercises begin in the second year, multipliers and divisors would not appear to go beyond 9 or, exceptionally, 12.

Multiplication and division are generally given more or less concurrently, but cases exist where it is preferred to begin division only after multiplication. In India (Mysore), Ireland, Luxemburg, Persia and Switzerland (Neuchâtel), for example, multiplication is broached in the second year, and division in the third.

In the third and fourth year, with very few exceptions, children are already doing all the operations within the range of the numbers they know.

To the study of multiplication and division may be linked that of divisibility and of the L.C.M. and H.C.F. which begin in some cases during the fourth year and more often during the fifth.

MONEY, AND WEIGHTS AND MEASURES

Frequent reference is made in the syllabuses for each primary year to exercises on money, and weights and measures.

In the first year the main emphasis seems to be on the small coins which come within a child's orbit and for which his interest is thus more easily aroused. In many cases he has also to learn to measure lengths at this stage. Methods and exercises appear everywhere very similar, whatever the system of measurement used, and in no cases is a child expected to deal with quantities involving a change of unit. In Belgium, Bolivia, Chile, Colombia, Ecuador, Nicaragua and Peru, natural or popular measures (hand, pace, etc.) are used for the initial exercises. Sometimes children at this stage have also to learn the different units of time (day, week, month) and to tell the time to within an hour or quarter of an hour.

Only rarely, judging from the syllabus summaries, is reference made to measures of capacity or to weights, in the first year.

In the second year, the study of two or three units of length, capacity and weight is approached in a much more general way. Importance is also attached to exercises on money, a topic which appears to be stressed throughout primary schooling. In the Union of South Africa (Natal), children at this level have to learn to work with different units of length (yard, foot and inch), capacity (gallon, quart and pint) and time (day, hour and minute).

In the third year, the general tendency appears to be to revise the work done in this connection in the second year, and to extend it only by taking additional units in each form of measurement. A beginning is made with calculations requiring some knowledge of conversion tables, and it is therefore at this level that the differences due to different systems of weights and measures begin to emerge. In Colombia and Portugal, measures of area and volume are first introduced in this year, and calculation of areas (whole numbers only) in France.

In the fourth and fifth year, children begin to learn of units beyond their immediate experience. Exercises on measures (multiplication and division, reduction) continue to be of importance, and measures of area and volume, and in some cases of angles, are introduced.

In the sixth year, it is of interest to note that in Ireland and New Zealand the children must study the metric system, while in those countries where that system is the standard one, they are learning to do the operations with compound numbers, in order to be able to deal with time and angles.

Decimals and Fractions

In regard to decimals and fractions, a distinction may be made between i) acquiring fundamental notions of them and ii) using them in sums.

From an analysis of the syllabus summaries given in the replies, it appears that first notions of fractions are acquired in one or other of the first four or five years of primary schooling.

Notions of fractions are mentioned in the first year, in Argentina, Belgium, Canada (New Brunswick and Newfoundland), New Zealand, Nicaragua, Poland, the Union of South Africa (Cape Province, Natal and Transvaal), Uruguay and Yugoslavia. In the case of Canada and Yugoslavia this reference amounts to no more than notions of a half. In Belgium, New Zealand, Poland and the Union of South Africa (Cape Province), on the other hand, it a question of notions of halves and quarters, with folding, measuring and dividing exercises as possible means of acquiring them. In Argentina, in the upper section of the first year, a child has to form notions of a half, a third, a quarter and a fifth. In Nicaragua and Colombia he is expected to go even further and study fractions down to a tenth, and also fractions such as $^2/_3$, $^2/_5$, $^3/_5$, etc., and to begin even, as in Colombia too, to do addition and subtraction with them. It is also of interest to note that in the Union of South Africa (Natal) a ruler marked in inches is employed to give the first notions of fractions.

Fractions make their first appearance in the second year, in Afghanistan, Australia (Queensland, West Australia and Tasmania), Austria, Bolivia, Canada (Alberta, Manitoba, Newfoundland, Nova Scotia, Prince Edward Island and Saskatchewan), Colombia, Ecuador, Finland, India (Kutch), Ireland, Italy, Portugal, Salvador, Switzerland (Neuchâtel) and the United Kingdom (Scotland). As in the first year, it may be no more than a question of notions of a half or of a half and a quarter ; such is the case in Australia, Canada, Switzerland and the United Kingdom. A third may be added, as in Austria, Finland, Ireland and Italy. Notions of fractions may be presented as a corollary of an initial introduction to division. Even where the emphasis is more on the fractions *per se*, their sequence is not necessarily the same ; it is, for example, $^1/_2$, $^1/_4$ and $^3/_4$ in

Afghanistan, and $^1/_2$, $^1/_4$ and $^1/_8$ in Bolivia, as long as $^1/_2$, $^1/_4$, $^1/_3$, $^1/_5$, $^1/_6$ and $^1/_{10}$ in Ecuador, and inclusive of all fractions with one-digit denominators in Portugal.

In the countries, listed above, where fractions first appear in the first year, the same topic is pursued in the second year in a somewhat more systematic way, which enables the children to learn all simple fractions whose denominators are not above 9, 10 or even 12, but does not go as far—Nicaragua and Colombia excepted—as operations with fractions.

It may be observed, moreover, that wherever an introduction to fractions is made in the first or second year, it covers only vulgar fractions, not decimals.

Fractions make their debut as late as the third or fourth year, in Australia (New South Wales, South Australia and Victoria), Canada (Ontario), France, Haiti, Holland, Hungary, Iceland, India (Mysore), Lebanon, Luxemburg, Norway, Pakistan (North West Frontier Province and Sind), Peru, Persia, Switzerland (Geneva and Vaud) and Syria. At this level, a beginning may be made with both vulgar and decimal fractions, the latter being easily introduced in any country using the metric system or a decimal system of weights and measures, and in all cases a rapid start is made with operations on fractions, details of which are given below.

In countries where the metric system is not in general use, such as Australia, Canada and New Zealand, the tendency is to postpone the study of decimals until near the end of primary schooling or even, as in the United Kingdom, until the beginning of secondary schooling.

It is thus obvious that so far as acquiring the basic notions of fractions is concerned, no universal tendency is discernable, and this is equally true of the second aspect of instruction in this connection, the use of the operations.

The addition and subtraction of fractions having the same denominator, and the four operations with fractions having 2, 4 or 8 as denominators, are done in Nicaragua and Colombia respectively in the first year. The syllabus summaries of these two countries are alone in mentioning operations with fractions at this stage, as also at second year level, when in Nicaragua the reduction of fractions to the same denominator is taken, and in Colombia the four operations with decimals (metres and centimetres, *pesos* and *centavos*) and simple fractions (halves, quarters, eighths, thirds, sixths, ninths, fifths and tenths), divisors and multipliers being limited to one-digit numbers.

In the provinces of Canada and the Union of South Africa, children begin operations with fractions, by learning to multiply a number by a fraction or, rather, to take a fraction of a number, the result often being limited to a whole number, in the third year. In Italy, Portugal and Uruguay children at the same level begin to use the four operations with decimals, but not with vulgar fractions, although they have already learnt the latter, and in Uruguay they take the addition and subtraction of fractions with the same denominator.

At the level of the fourth year, decimals are being used in practically all countries whose system of weights and measures is decimal, while elsewhere the main emphasis in this connection is on multiplying a number by a fraction.

Whatever importance, however, is attached to preliminary work with operations and fractions, the principal part of the work on them is done during the fifth and sixth years, and this work is facilitated by previous study of L.C.M. and H.C.F.

Work on decimals, it is worthy of note, is rarely done to more than four places.

GEOMETRY

The discussion on the role of geometry, in the first section of this survey, revealed certain differences of approach, which may be summed up as differences concerning i) the limits of geometry, ii) the number and sequence of topics, and iii) the level at which a topic is introduced.

So far as the question of the limits of geometry is concerned, geometry for the purposes of the present study has been assumed to cover everything connected with the measurement of magnitude, and the study of space and its properties, from the measurement of a segment or the observation of form and of the relative positions of solids, up to the determination of areas and volumes.

As to the number and sequence of topics, it appears from an analysis of the syllabus summaries that geometry begins to be important from the third year onwards, and that the main concern then becomes the study of two- or three-dimensional forms, and the determination of perimeters, areas and volumes.

Towards the end of primary schooling, differences of approach appear in the number of figures whose area has to be determined —trapezia and circles, for example, may or may not be included, and still more in that the determination of volumes may or may not be included. Certain other differences also appear which are probably due to the variety of aim attached to the subject, such as the inclusion or non-inclusion, mainly from the fourth year onwards, of the study of lines and angles, parallels and perpendiculars, and certain problems of geometrical construction.

The mere enumeration of these items forces one to conclude that a certain systematisation of geometry teaching exists, which alone gives rise to differences in the sequence in which the various items are dealt with. That sequence, from one point of view, may be lines, angles, surfaces and, finally, volumes, while, if one prefers to become progressively abstract, it is more or less the reverse—volumes, surfaces, lines and, finally, points. In the second case, the study of volumes and surfaces may be taken up again towards the end of schooling. Characteristic of these two positions are Australia (Queensland and South Australia) and the Union of South Africa (Transvaal) on the one hand, and Argentina and Colombia on the other.

Apart from the outstanding difference in the syllabuses, mentioned above, that the determination of volumes may or may not appear during the fifth or sixth year, the greatest differences of approach as regards geometry are to be found in the syllabuses covering the first three years of primary schooling.

These differences for the most part express themselves as differences of the level at which any given topic is introduced. In some countries (Argentina, Manitoba in Canada, Colombia, Ecuador, Italy, Poland and Uruguay), certain observations on solids appear in the first year, in others not until the fourth. Sometimes geometry may begin with lines or the measurement of length in the third year, in some cases, as in Manitoba, Ontario and Quebec in Canada, the latter exercise being preceded by a preliminary comparison of magnitudes. In other cases, as for example in Nicaragua, Salvador, and Cape Province, Natal and Transvaal in the Union of South Africa, measurement appears as early as the second or even the first year.

PLACE OF PRACTICAL WORK

In reply to that part of the International Bureau of Education's questionnaire dealing with the place of practical work, nearly every country has stated that the utmost importance is attached to it, and some that it may take up as much as a half or even three quarters of the time devoted to mathematics. This appearance of almost complete unanimity, however, probably conceals big differences between one country and another, as comparison of the various replies clearly shows that the term " practical work " has been interpreted in a variety of ways.

" Practical work " may be taken as meaning, for example, the solving of everyday problems involving the application of the theory that has just been learnt. This appears to be the case in Chile, the Dominican Republic, Haiti, Holland, Pakistan (Punjab), Salvador, Switzerland (Neuchâtel), Thailand and the Union of South Africa (Cape Province and Transvaal).

Elsewhere the same term represents, not so much problems involving the application of knowledge, as opportunities of placing children in real situations capable of arousing their interest and of helping them discover certain underlying principles. " Practical work " then no longer follows teaching, but precedes and supports it. An approach of this kind would seem to predominate in, for example, Argentina, Austria, Canada (British Columbia, Nova Scotia and Ontario), Colombia, France, Norway, New Zealand, Persia, Poland and the Union of South Africa (Natal). It is also to be found in Belgium, Canada (Manitoba and New Brunswick), Korea, Hungary, Ireland, Lebanon and Peru, but with an emphasis on practice in measuring and weighing.

In the replies, moreover, from the United Kingdom, covering England and Wales, it is interesting to note that the term " practical work " is said to be gaining a fuller meaning, and now " embraces not only doing, but also thinking and talking about situations in which environment plays a significant part."

Incidental Teaching

All the countries replying to the present inquiry (with the exception of Bulgaria, Denmark and Hungary), endeavour to articulate the introduction to mathematics at primary level with other subjects, by a) taking data for arithmetic problems from other subjects, and b) using opportunities arising in lessons on other subjects to teach mathematical ideas.

Social studies, geography, study of surroundings, natural science and handicrafts would appear to be the most suitable subjects for effecting an articulation of this kind. Drawing, the mother tongue, physical training and reading are also mentioned in the replies in this connection. In countries, moreover, such as Australia and Canada (Ontario), where " project " or " enterprise " methods are employed, numerous situations arise in which the traditional boundaries between the various school subjects no longer really exist.

As examples of items in geography or social studies syllabuses lending themselves especially well to an articulation with mathematics, may be cited estimating and verifying distances and areas, calculating distances between towns, comparing the length of rivers, roads and railways, and altitudes and depths, studying the geographical coordinates, population densities and production statistics (in connection with agriculture, precious metals, minerals, etc.), making maps, and drawing and interpreting graphs. Items of this kind are abundantly quoted in the replies from Belgium, Bolivia, Colombia, the Dominican Republic, Ecuador, France and Poland.

As examples, furthermore, of mathematical problems arising in geography, Holland cities calculating the duration of a journey, and distances, which involves the idea of average speeds, etc. The ethics and civics syllabus in Venezuela includes a study of the origins of money.

As to the study of surroundings, it is mainly the physical aspects of the subject which give opportunity for practice in measuring and reckoning, as the replies from the Dominican Republic and France make clear. Ecuador refers to meteorological observations, which involve calculating daily, monthly and yearly average temperatures, and drawing graphs of them. The reply from the United Kingdom (England and Wales) speaks of recording the growth of a plant over a prolonged period, and of the need for long division, on the occasion of a visit to a farm, in order to calculate the cost of feeding stuffs. Similar problems in regard to costs, arising in the course of nature study or agriculture, are mentioned in the replies from Finland and Salvador.

The replies from the United Kingdom (Scotland), Finland, Peru and Venezuela mention in this connection the measuring a child needs to do in handicrafts, to make an object in cardboard or wood; in Finland he has himself to calculate how many planks he needs for the table he is going to make.

The reply from Ireland speaks of the right angle as a measure of rotation needed in physical training, and of shopping, weighing and measuring as topics for language lessons.

METHODS

The instructions on methods given in the official mathematics syllabuses are for the most part either very precise and detailed, or limited to generalities.

In Iceland, India (Kutch) and Thailand, the tendency is to give teachers instructions on methods at the normal schools or in the course of inspectors' visits.

In Canada (Prince Edward Island), India (Bihar), and Pakistan (Baluchistan and North West Frontier Province), official instructions are confined to recommending books on the subject.

In Finland, there are no official instructions, but certain government committees have published suggestions to which teachers may refer.

In some cases, official instructions concentrate on certain special cases. In Scotland, for example, recommendations as to methods (so far as the county and city schemes of work are concerned) are limited to instances where it is to the advantage of the children that such methods should be uniform over a given area, e.g., methods concerning subtraction with borrowing, multiplication by two or more digits, and position of quotient in division.

In Australia, official recommendations exist in all states, but the use of any particular method is rarely obligatory, teachers having the greatest freedom in this connection.

Instructions on method have been issued in Salvador simply because mathematics has proved the most difficult subject to teach. In Austria and Lebanon, there are no official recommendations whatsoever.

In comparing the various recommendations with each other, as they are given in the replies, it appears that with few exceptions the differences that emerge are not ones of principle, but of the points selected for emphasis.

Such points can be grouped under the following heads :— i) activity methods and interest, ii) the appeal to intuition, iii) mechanical skills, order and neatness, iv) sequence, and v) group and individual differences.

Activity Methods and Interest

Teaching certain mathematical ideas by setting a child to work with concrete things, is a common procedure, as for example in Austria, Bolivia, Canada (New Brunswick, Quebec and Saskatchewan), Chile, Colombia, France, Italy, Luxemburg, Norway, Peru, the Philippines, Syria, Turkey, the United Kingdom (England and Wales), Venezuela and Yugoslavia.

In Chile, teachers are officially recommended to " distinguish two fundamental and characteristic aspects of the teaching of mathematics, firstly the scientific aspect concerning knowledge and the search for truth, and secondly the technical aspect the aim of which is the practice and acquisition of immediately utilisable skills." The two resulting teaching procedures each have three stages (formulation, fixation and application), which the children pass through by means of appropriate activities.

In Bolivia, it is suggested that teachers provide their pupils with varied material with which they can observe, manipulate, experiment, analyse, discover, formulate, define and generalise for themselves.

In Ireland, similar emphasis is put on the desirability of children being led to discover principles and methods for themselves, and in Norway, of them being set to solve problems which they themselves have raised.

The New Zealand reply quotes the conclusions of a recent report (" Arithmetic in Junior Schools," published in 1940 by the Training College Association, London) : " Although it is true that some children find satisfaction in the correct working of sums that are either purely mechanical or are solutions of quite unreal problems, it is now realized that children in the junior school reach a better command of the arithmetic they will need to use in adult life if they are trained in the early years to work out calculations which they themselves require to make something or to understand a real situation. This is the essence of the project method. Where a class or group of children need to measure, to count or to reckon before they can carry out an interesting scheme such as the construction of a model railway-station, the printing and selling of tickets for a school entertainment, or the making of a hutch for a class pet, they will be using their number knowledge as a means to that end. For the majority of children this is the best stimulus and should be used whenever the occasion offers. There will be some interests, such as transport, newspapers, the post-office, which will be deepened and enriched if quantitative comparisons are made and experiences requiring measuring, counting, weighing, and trading are included. These types of project may well be used to give meaning to arithmetic and to give the children practice in calculations through pleasing and natural occupations. At any period in the junior school the appearance of a strong interest of this kind should be welcomed and fully used."

It is insisted, further, in the conclusions of this same report, that a project should be used for introducing arithmetic to children, only if arithmetic is really and truly necessary to its execution, and is felt by the children to be so, and to add to its interest.

The New Zealand reply endorses these conclusions in regard to projects, and at the same time recognises the difficulty, in small all-class rural schools and crowded urban schools, of going as far with project work as might be theoretically desirable.

In France, a ministerial circular (dated 7th December, 1945), referring to principles given in instructions issued as far back as 1923, states : " Actual manipulation should always come before arithmetical manipulation, and everyday terms before mathematical ones... Facts form the necessary foundation for calculation and thought..."

Group and cooperative work is recommended in Bolivia and Canada (Manitoba).

Activity methods may take the form of educational games, especially at nursery-infant or lower-primary level, in Argentina, Australia, Bolivia, Canada (British Columbia, Manitoba and Quebec), Chile, Colombia, Czechoslovakia, Ecuador, Finland, Holland, Hungary, India (Mysore), Ireland, Peru, Persia, the Philippines, Switzerland (Geneva), the United Kingdom and Yugoslavia.

These games are of the most varied kinds. In Argentina, for example, they involve actions such as joining, taking away, repeating and dividing, and in Chile, make use of national and foreign folklore, and of ordinary or specially invented games. In the replies from Chile, Colombia, Ecuador, Finland and the Philippines, mention is made of games involving commercial activities such as buying and selling, and giving change. Other examples, taken at random from the replies, concern the work of a postman, going up and down stairs, dominoes and lotteries. Estimating quantities by ear, eye and hand is also mentioned, sensory training of this kind being deemed suitable for forming quantitative concepts.

In England and Wales it is more common to find games which " encourage automatic response to simple number bonds in scoring, than those which have some genuine mathematical content. "

Even where children's games and spontaneous activities are not deemed adequate for imparting new ideas or giving practice in skills, official instructions nevertheless stipulate that mathematics should be taught practically, avoiding sterile theory and concentrating above all on problems arising in the children's own lives, the subject thus being made, not an end, but an instrument. Recommendations to this effect are expressed in the replies from Afghanistan, Argentina, Belgium, Bolivia, Canada (Manitoba, New Brunswick, Quebec and Saskatchewan), Finland, India (Mysore), Korea, Nicaragua, Pakistan (Sind), Portugal, Salvador, Sweden, Switzerland (Basel-City and Geneva) and Venezuela.

As noted already, a child's interest may be sustained by concentrating the various subjects he has to learn into one centre of interest. Such a procedure is officially recommended in Bolivia, the Dominican Republic, Sweden and Switzerland (Vaud).

In some countries, certain teaching attitudes are recommended as being specially suitable for sustaining a child's interest in mathematics. The teacher in Bolivia, for example, is recommended to " confine himself as a rule to guiding, correcting and explaining..." In Salvador, his " attitude should be one of understanding and encouragement, towards even the most minute details of the work his pupils do ", and he should not help his pupils to solve problems, " unless they quite fail to do so by themselves." In Norway, the need is stressed of setting children to work on problems " which they themselves have raised. "

To the above tendencies in regard to children's interest, however, certain limitations are made in some cases, or even opposition.

In Canada (Newfoundland), for example, it is officially suggested that a child's " own needs and interests are not enough to determine the instructional material : the needs of the future must be considered. To follow only the interests of the child would undoubtedly ignore the desirability of organized skill. Conventional as they are, these matters cannot be neglected in favour of any theory of instruction that is not supported by a reliable body of objective data. "

The note of limitation is even clearer in the reply from Bulgaria : " Solving a concrete problem may occasionally take the form of a game, but in principle activity methods are rejected, inasmuch as they come between a child and his textbook and thus prove detrimental to the systematic acquisition of knowledge."

The reply from the United Kingdom (England and Wales) stresses, in this connection, that the recommendation (made in the "Primary School Report" of 1931) to evaluate the teaching of young children in terms of "activity and experience", is heeded perhaps less in mathematics than in any other subject.

THE APPEAL TO INTUITION

In certain countries, the officially recommended or most commonly used procedure in teaching mathematics consists in moving always from a concrete situation towards its abstract, underlying principles. The methods whereby pupils act as observers are generally called "intuitive" (or inductive) methods (they are, of course, not the only methods employing intuition), and according to the replies they are mainly used in Afghanistan, Bolivia, Ecuador, Finland, Haiti, Hungary, Iceland, Ireland, Italy, Nicaragua, Pakistan (Karachi and Punjab), Persia, Portugal, Salvador, Switzerland (Vaud), and the Union of South Africa (Cape Province).

MECHANICAL SKILLS, ORDER AND NEATNESS

In Belgium, official instructions insist that the mechanical skills in arithmetic are a routine aspect of the subject, which has to be accepted, and that such skills be used to create greater freedom for the mind and as a means to acquiring further knowledge.

One suggestion, moreover, contained in the arithmetic syllabus for the Union of South Africa (Natal), runs as follows : "The period of educational life from standards I to IV is normally the stage when drill methods are most effective and when lifelong habits may best be formed. These points should be borne in mind by teachers of these standards, and they should make every effort to see that the elementary tables are then thoroughly acquired... "

The marked emphasis in these examples on the importance of teaching mechanical skills is also to be found in the replies from Afghanistan, Austria, Bolivia, Canada (British Columbia, New Brunswick, Quebec and Saskatchewan), Chile, the Dominican Republic, Korea, New Zealand, Pakistan (Punjab and Sind), Salvador, Sweden, Switzerland (Geneva and Zurich) and the Union of South Africa.

To obtain mechanical skill in speed and accuracy, short and frequent practice in mental arithmetic and written work is recommended. One of the riders sometimes added to this recommendation is that accuracy is more important than speed.

In Portugal and Sweden, it is emphasised that teachers should correct all written work with great care.

In the Union of South Africa (Natal), accuracy is stressed, and, moreover, the teacher's " blackboard work must be as perfect a model as he can make it. Pupils are strongly influenced by the blackboard work which they see in front of them. The arrangement of every written exercise should be a matter of careful study."

The same care for neatness and order is expressed in the primary curriculum for Quebec's Catholic schools, in Canada : " Written calculations should be simple, orderly, and neatly done ; rough work is not allowed in arithmetic. A child should set out his answer in such a way that it is easy to follow and understand his reasoning. The actual amount of a child's knowledge contributes far less to his development than his grasp of good methods of work."

Pupils should be trained to judge whether their answers to sums are within the limits of possibility, in the Union of South Africa (Cape Province and Natal). In Salvador, on the other hand, teachers " should not be discouraged when their pupils give them wrong answers, since discovering the cause of mistakes is excellent mathematical training ". In Switzerland (Basel-City), great importance is attached to preciseness of expression in arithmetic lessons.

It is also worthy of note that the reply from New Zealand refers to the fact that there is a great deal of transfer of pupils from school to school, and that this provides a particularly good case for uniformity of method in certain mechanical operations, as variety would in such circumstances lead to confusion, and waste of time and effort. The methods therefore proposed are a) subtraction by complementary addition with adjustment by the method of equal additions ; b) multiplication from right to left (the method at present generally used in primary schools) ; and c) the quotient to be placed on top in all types of division, except in certain operations in conversion.

This desire to avoid a change of method is also to be observed in the Catholic schools of Quebec in Canada : " Teachers should take note of the procedures already learnt by their pupils. In our schools, subtraction is taught by taking away and borrowing, but if a teacher notices that certain pupils proceed in a different way, he should take care not to compel them to change."

Some remarks in the replies from Bolivia, Ireland and Switzerland (Vaud) are to a certain extent in opposition to the general tenor of the recommendations dealt with so far, in regard to the mechanical skills. In the Bolivian reply, the importance of mental arithmetic is stressed, but purely abstract, mechanical, mnemonic and dogmatic procedures are considered quite worthless. In Ireland, the investigation or examination of principles is deemed of more importance than the mere working of rules. The reply from Switzerland (Vaud) states : " At all levels, arithmetic must call for the use of intelligence, and not simply be the mechanical application of given rules or principles. Children should be given frequent practice in simplifying as much as possible."

SEQUENCE

The following opinion is quoted in the New Zealand reply, from a recent report ("Arithmetic in Junior Schools," mentioned above) :—

"The necessity of logical development in the teaching of arithmetic and the importance of completely mastering one process of calculation before a new step is attempted combine to make this subject traditionally one of the most abstract and academic in the curriculum of the elementary school."

To remedy this state of affairs, the report goes on to recommend the adoption of the project method. It adds that such a way of learning is nevertheless limited by the obvious logical difficulty that a numerical process cannot be learnt unless the necessary preliminary processes are known, and finally reaches the following guarded conclusion :—

"If projects and interests are allowed to develop at intervals during the... course, such arithmetic as is essential to them will be learnt, but the committee would urge the importance of keeping a logical scheme intact and of providing regular opportunity of practice in arithmetic skills."

This same emphasis on the importance of sequence is also found elsewhere, expressed in terms of logical development, of acquiring and periodically revising certain items before proceeding to the study of new ones, and of the careful grading of syllabuses. Recommendations to these effects are made in particular in Australia, Bolivia, Canada (New Brunswick, Ontario, Quebec and Saskatchewan), Denmark, the Dominican Republic, Ecuador, Nicaragua, Norway, Peru, Sweden, and the Union of South Africa (Cape Province, Natal and Transvaal).

"Work should be difficult enough," runs the reply from Quebec's Catholic schools, for example, "to stimulate effort, but difficulties should be so well graded and adapted to a child's rate of progress and actual capacity that he comes to regard a setback as something unusual and unexpected." The need for sequence is referred to by the reply from Ontario in the following terms : "The grade placing of the various topics of the course has been determined by the published results of research in this field and by the experience of competent and thoughtful teachers of arithmetic."

The Union of South Africa (Natal), again, speaks of right sequence as follows : "The great secret in arithmetical progress is gradation of exercises. Gradation implies the provision of a set of easy steps to a higher level ; the steps must lead to a definite end, and it must be easy to pass from one to the next. It may be fairly compared with the increase in railway efficiency caused by diminishing gradients ; the journey is made in shorter time though the distance has been longer."

Finally, as an example of how the question of sequence has been treated in the replies, the following may be quoted, also from the Union of South Africa (Transvaal): " Each school must draw up its own scheme, and it is the duty of the principal to ensure that it is properly graded and coordinated so that there will be continuity and regular progress. Each class teacher should be acquainted with the requirements of the school's scheme as a whole, and must have a thorough knowledge of the requirements of the schemes of the years preceding and following her own standard. She should realise that she is a link in the chain, the strength of which depends on the strength of its weakest link."

The reply from Australia, on the other hand, states that sequence of topics " is ensured by the arrangement of the course of study, from which few teachers depart radically ", but that it is uncommon " for a method of instruction or treatment of a topic to be prescribed, considerable freedom being given to teachers to choose their own methods. "

In Finland and Sweden, moreover, teachers are at liberty to begin vulgar fractions either before or after decimal fractions.

Finally, mention should be made of the importance attached, more especially in Canada (Alberta and Manitoba) and New Zealand, to learning vocabulary. The reply from New Zealand, for example, refers to a suggestion in its " Revision Syllabuses " which states: " Failure in arithmetic is sometimes due not to any inability to grasp numerical relations, but to partial or complete ignorance of the meaning of terms; and such ignorance is often more widespread than is generally supposed. In an effort to encourage greater attention to the vocabulary of arithmetic there has been appended to the prescription for each class a list of the terms that should be known." The use of lively number readers, especially in primers 3 and 4 and standard I, is also recommended.

GROUP AND INDIVIDUAL DIFFERENCES

In some of the replies the view is taken that it is perhaps desirable to use different methods at different primary levels.

The reply from the United Kingdom (England and Wales), for example, states that, insofar as inspectors' courses for teachers are concerned, the general tendency is " to draw teachers' attention to the way in which children learn at various stages of maturation rather than to deal with details of subjects. "

A similar concern to adapt methods to the children's mental stages in the various classes is also expressed in the replies, among others, from Austria, Belgium, Bolivia, Canada (Ontario and Quebec), Colombia, Ecuador and Syria. In Bolivia, for example, lessons should be general and concrete in the lower classes, and reasoned and appealing to the inductive and deductive faculties, in the upper ones. Similarly in Syria, teaching begins " with concrete realities, and leads on gradually towards deductive processes."

In Bolivia, Canada (Ontario and Quebec), Colombia, Pakistan (Sind), Switzerland (Basel-City), and the Union of South Africa (Cape Province), it is considered equally or even more desirable to adapt the syllabus content itself to a child's level and to local circumstances.

Many countries also deem it of importance to pay due regard to individual differences.

A marked emphasis on individual teaching or the particular aptitudes of individual pupils or groups of pupils, is to be found in the replies from Afghanistan, Australia, Bolivia, Canada, Chile, Norway, the Philippines, Salvador, Sweden, Switzerland (Geneva), the Union of South Africa (Cape Province and Transvaal), and Uruguay.

In the Chilean reply, for example, it is stated that teachers are recommended "to devote three weeks to the organisation of their class and their teaching, before beginning on the syllabus itself. During these three weeks, a teacher gets to know his pupils through questioning them, watching them working, and giving them tests of the 'knowledge-inventory' type. He can thus discover what they have really grasped from the previous year's work, discover deficiencies and weak points, and determine what each child will have to learn, correct or learn," and, on the basis of knowledge gained in this way, "proceed to divide his pupils into homogeneous groups, and adapt the syllabus to individual differences in ability, interests and inclinations..."

The replies from Canada (New Brunswick, Nova Scotia, Ontario and Quebec), insist on the necessity of teachers giving their pupils periodical tests in order to discover weak points and diagnose difficulties, and to follow up such tests with remedial teaching, if need be. In this connection, the New Brunswick reply adds that remedial teaching, "to be of real value, must be individualised, so that each child is drilled on the particular points which he found difficult. In order to do this, teachers will find it necessary to make use of printed and written material for the child's individual use."

Certain recommendations concern the attitude to be adopted towards the mathematically more gifted pupils. The replies from Bolivia, Sweden and the Union of South Africa (Transvaal) suggest that such pupils should be set more important and more difficult work. Teachers of large classes in the Transvaal may also ask pupils of this kind to assist the less gifted members of the class.

In Canada (New Brunswick), moreover, it is officially suggested that for mathematically inclined children, supplementary arithmetic textbooks with suitable problems should be available to supply their needs; in this way much profitable extra work may be done by these children (while their comrades are obtaining mastery of the minimum required skills), or they may be permitted to work on some class or group activity, or to read for enjoyment.

TEXTBOOKS AND TEACHING MATERIALS

TEXTBOOKS

Textbooks are generally held in high regard as an aid in the teaching of mathematics at primary level, at least from the second or third year onwards.

The choice of mathematical textbooks appears to depend on regulations covering school textbooks in general, and thus offers no points of special interest for the present study. There are three main ways of deciding what textbooks shall be used in a school, for mathematics as for other subjects :—

a) Official textbooks exist, whose use is compulsory.

b) Some central authority draws up a list of authorised or approved books, among which teachers or headmasters may make their choice.

c) Teachers or headmasters are free to use any available textbooks, or not to use textbooks at all.

There are, however, certain countries which do not follow any of these three procedures.

In Argentina, for example, a textbook may be used for one subject only, namely reading. In Bolivia, Syria and Venezuela, the tendency is not to use a textbook for mathematics, but for each student to have his own notebook. Pupils in Finland too, make their own notes, but these may be merely ancillary to their textbook. In Chile, again, no textbooks are used, the teacher being expected to make up exercises and problems himself on the basis of the syllabus recommendations. In France, in schools practising activity methods and individual teaching, the place of textbooks is taken by arithmetic cards and, wherever the need arises, books of reference.

The Belgian reply makes the following comment on the question of using textbooks :—

" True activity teaching does not lend itself readily to the use of textbooks or set problems. Books offer no suitable material for a teaching which is in close connection with the environment and real life. Observing and estimating real things, consulting catalogues, time-tables and price-lists, are much more attractive and interesting than the standardised unchanging data given in textbooks. Lists of definitions, rules and principles have no place in a programme which outlaws verbalism. If absolutely necessary, certain books imbued with the spirit of the ' Plan d'Etudes ' might be allowed, but they will no longer come as dictatorial guides, to be followed page by page, but merely as useful auxiliaries affording variety in subject-matter and revision exercises...

"Being more adaptable than textbooks, various aids are coming more and more into favour among teachers—arithmetic cards (for functional work, revision, acquiring mechanical skills, and problems), exercise-books and pictures for the teacher's and pupils' introduction, systematising and synthesising, problems arising from the environment or life itself (estimates, a scheme for draining or distributing water, building something, preparing a meal, estimating complicated costs at the end of a certain period of time, or quantities needed)."

Wherever textbooks are used, an endeavour is made to adapt them, not only to the children's intellectual level and to the syllabus requirements, but also to the locality.

In Australia (Victoria), for instance, there are special textbooks for the rural schools. Hungary has three different editions of each textbook, adapted to the interests or urban, village and country children respectively. In Poland, the same textbooks are used in urban as in rural areas, but the exercises are sufficiently numerous to make a suitable choice possible in each case. In Haiti, textbooks are obtained from abroad, and adapted by the teachers to the country's requirements. In the Union of South Africa (Transvaal), it is felt that no single textbook can possibly serve the needs of every school, and the class teacher is accordingly expected to draw up supplementary exercises that will meet the special needs of his neighbourhood ; sets of textbooks, moreover, are available for each class, which provide for two groups of different ability.

In Colombia, Czechoslovakia and New Zealand, new textbooks are being drawn up in the light of recent experience and experiment.

Teaching Materials

In almost all the replies, some indication is given of the materials used, mainly in the lower classes, for giving first notions of number and for doing the operations in a concrete form.

Such materials consist for the most part of things obtainable easily and practically without cost from the environment, such as pebbles, shells, beans and other seeds, dead matches, marbles and beads. The ball-frame is still widely used, but in Belgium and Luxemburg is tending to disappear.

A good many of the replies also speak of the use of objects that may be readily purchased, such as draughts, counters, counting sticks, cardboard lottoes and dominoes, pictures, cubes, plasticine, cards for patience, and imitation banknotes and coins. Montessori material is sometimes used in Denmark and Pakistan (Karachi and Punjab).

The following comment, on the other hand, in connection with teaching materials, occurs in the reply from the United Kingdom (England and Wales): " It is still common to find specialised apparatus for the early teaching of number, i.e., concrete material specially designed to illustrate number notation and number relationships. It is however increasingly common to find much of this being displaced by activities which stimulate real-life situations, and by actual experiences."

A similar comment on teaching materials occurs in the Belgian reply: " Old-fashioned teaching aids were often conceived by grown-ups with commercial rather than educational aims in view, and are fast disappearing from the classroom (ball-frames, arithmometers, bowls, counting sticks, constructional games). In nursery-infant classes hardly any expensive or complicated apparatus is now to be found, but only beads, paper, scissors, clay, crayons, and various objects found on walks. At the primary level the best and most efficient material is provided and made by the children themselves, as and when they explore their surroundings or as the need arises... Pupils also feel the need to make certain measuring instruments themselves—the metre, decimetre, cubic metre, set-square, balance. The pupils can also bring things to make a collection of measures of capacity, in the course of their activity at school—the household pail (a decalitre), a vinegar bottle (a litre), a bottle from the chemist's (a decilitre), a scent bottle (a centilitre), a medicine bottle (a centilitre). The sand-tray is used in a good many classes; it helps greatly in introducing geography and is a means of teaching a host of arithmetical ideas in a living form."

In France, many teachers have shown no little ingenuity in the field of teaching materials, thinking them out themselves and making them from odds and ends; students at the normal schools are encouraged to invent educational games for the introduction to mathematics, frequently with the most surprisingly successful results, and inspiration deriving in many instances from lotto, dominoes, buying and selling, and the like.

In the Dominican Republic, teaching materials for mathematics are generally made in the handicraft classes with the help of the handicraft and domestic science schools attached to primary education. In Bulgaria, on the other hand, the manufacture of teaching materials is the responsibility of a specialist firm.

A fair number of replies, finally, mention the use of measuring and drawing instruments, a use which may extend into lessons other than those on mathematics.

REVISING MATHEMATICS TEACHING

The attention given to mathematics by syllabus revision committees witnesses to both the importance and the difficulty of the subject.

The latest reforms of mathematics syllabuses in Argentina, Czechoslovakia, Poland, Salvador, and the Union of South Africa (Orange Free State), have mainly concerned subject-matter.

In Argentina, for example, such syllabuses were drawn up " on the firm basis of what a child can really learn, and so avoid the ' encyclopedic ' approach which would be fruitless or even harmful. " In Poland, the aim of the latest modifications is to eliminate almost all the commercial elements in the old syllabuses, and replace them with items " more in harmony with the country's new way of life, which includes nationalised production, new conditions of work, and a transformed attitude to culture. " In Czechoslovakia, the chief concern is to change the content of problems, also in the light of the country's new economic structure. Subject-matter rather than actual teaching is also the object of the most recent changes in the Union of South Africa (Orange Free State), made " to discard useless lumber and to put the emphasis on the practical figuring demanded by business and life. " In Salvador, the first draft of a new syllabus suggests that among the four operations, only addition and subtraction will in future be taught in the first class.

The reply from Italy refers to the fact that, given the present level of prices, " it is generally held that the limits set for counting and for the four operations are too low. It has been observed that children of six to eight years of age can already acquire notions of a hundred and a thousand. "

In other countries, on the contrary, it is not content so much as methods which are the object of reform. This is the case, for instance, in Luxemburg and Peru, where the aim of the most recent changes is to introduce activity methods.

Most often it appears, however, that changes concern both content and methods, the one being a function of the other.

The syllabus, for example, of Quebec's Catholic schools, in Canada, published in 1948, was drawn up in such a way " as to simplify and lighten as much as possible the old syllabus and give it a more flexible content capable of adaptation to individual teacher's methods, the ability of their pupils, and the needs of a particular environment ", and to make possible " the use of activity methods which allow for the free play of a child's powers, stimulate the growth of his natural interests, and thus induce him to like his school. "

Mainly in the last ten years, an attempt has also been made in Chile to free the teaching of mathematics from " the routine, mechanical and abstract nature " with which it was invested. With this end in view, changes were made in both the general and particular objective of the subject, and in the methods and materials used. The changes in general aim have made it possible " to stimulate a child's psychological development, and to give him greater understanding and activity in regard to social problems. " The modifications in particular objectives took account " of pupils' potentialities and the needs and interests proper to each stage of their development. " Various committees of specialists and teachers chose the new teaching materials in the light of "their training and educational value, and the frequency of their applicability to social problems. " These materials were also graded in respect of certain difficulties, with constant care " to build each new concept or technique on the firm foundation of already acquired knowledge and skill ", and in such a way as to assist in " the transition from purely local to universal interests. " The endeavour was also made to make the teaching of mathematics only one of many ways of " guiding a child's activity into the desired direction, while maintaining an immediate unity and social purpose in keeping with the true laws of learning. "

The new course of study in the Philippines stresses the importance of practical concrete materials for the development of number concepts, and discards those intended merely for " mental gymnastics ".

The new mathematics syllabus issued by the Colombian Ministry of Education in 1941 aim at being more in keeping with " school needs and teachers' levels of training. "

The Hungarian educational system has been influenced by that of Soviet Russia, which rejects " formal and mechanical teaching " and replaces it with solving problems that are " extremely varied in nature, purpose and type ". Pupils have to set themselves problems, which they then have " to analyse and solve. "

The " Revised Syllabuses " now in use in New Zealand were published by the Education Department in 1948. Some of the reasons for modifying the old syllabuses, and a summary of the changes made, are given in the New Zealand reply coming in the second part of this volume. It is of special interest that cuts in the scope and complexity of the work prescribed have been made, not merely in the interests of simplification in general, but also because increasing use is now made, in the adult world, of ready-reckoners and calculating machines for doing laborious computations, and children should thus be taught to construct and use ready-reckoners ; they are efficient time-savers, and work with them provides a good introduction to tabulation. Practical activities with weights and measures, moreover, now appear earlier, such work being suitable for counteracting the tendency, especially marked in the first two primary classes, to concentrate too narrowly on mechanical operations. In all classes, furthermore, more social arithmetic (the " application of arithmetic to domestic, economic and civic conditions of life ") is now prescribed. A quite new departure, finally, is the inclusion of " spatial knowledge " in the syllabus for the first three primary classes. Good reasons were advanced for this step, including the authority of the " Hadow Report ". " Interest in shapes, " runs part of the report already quoted above (" Arithmetic in Junior Schools "), " is older than the Egyptian pyramids and as new as the latest examples of modern architecture, " and " the basic ideas of geometry—viz., symmetry, size, and position (including orientation or lie)—are as important as counting and serve as a means of mental development particularly stimulating to children who find difficulty in work with abstract number ".

In the United Kingdom (England and Wales), it is considered that the teaching of mathematics at primary level is still " heavily handicapped by traditions inherited from the old ' all-standard ' school containing children from seven to fourteen years of age, and by the use of skill in reckoning as a criterion for selection for types of secondary education. " " There is however ", the reply continues, " a growing movement for reform in terms of a child's needs and consideration of his whole growth. "

The new syllabus being introduced in India (Kutch) pays less attention to arithmetic tables, which " were formerly crammed and a regular drilling given in them every day at home and in the school ", and which were nevertheless " very helpful in after life ". Cramming is now " discouraged and scientific study is encouraged. It is felt that the tables and short cuts to mental arithmetic should be given proper place. "

The latest reforms in France may serve as a kind of synthesis of the various trends outlined above. They have a double aim :-

a) to restore to primary teaching in France " its pristine simplicity and efficiency in regard to the acquisition of the basic skills, " and

b) to ground such teaching " in larger measure on facts and individual observation, in order to give French youth the *grand bain du réalisme*—the touch of reality—of which it stands in need. "

BIBLIOGRAPHY

Most of the official syllabuses consider the various specific and general problems of the teaching of mathematics, and numerous books have been published on the subject. References to such books will be found in the " Miscellaneous " section of the replies from Australia, Austria, Belgium, Bulgaria, Canada (British Columbia, New Brunswick and Prince Edward Island), Chile, Colombia, Denmark, the Dominican Republic, Finland, France, Holland, Hungary, Iceland, Ireland, Italy, Norway, Persia, the Philippines, Poland, Portugal, Salvador, Sweden, Switzerland (Geneva and Neuchâtel), the United Kingdom (England and Wales), and Yugoslavia.

AFGHANISTAN

From the reply sent by the Ministry of Education

Place of Mathematics in the Curriculum

Under the heading of " arithmetic and geometry ", mathematics is taught in Afghanistan from the first primary class (children of seven years of age) onwards. Four periods a week are devoted to the subject in all classes except the 5th and 6th boys' classes, in which five periods are allotted.

Geometry is taught as a distinct subject only from the fifth class onwards.

Syllabuses

The main points of the arithmetic and geometry syllabus are as follows :—

1st *class:* numeration up to 100, notation up to 20 ; the four operations in a concrete form, and abstract addition and subtraction, within the range 1-20 ; Afghan coins (10, 20 and 50 *puls* and 1 *afghani*) ; metre and kilometre ; day, week, month ; signs.

2nd class: revision of numbers up to 100 ; numeration up to 1,000, notation up to 100 ; the four operations in a concrete form, and abstract addition and subtraction, within the range 1-100 ; multiplication of one- or two-digit numbers by 1, 2, 3, 4 and 5 (product less than 100) ; division of a two-digit by a one-digit number ; simple exercises on the four operations ; mental arithmetic ; the fractions $^1/_2$, $^1/_4$ and $^3/_4$; coins, weights and units of length and time.

3rd class: numeration and notation up to 100,000 ; addition and subtraction with numbers up to four digits ; multiplication of a two-digit by a two-digit number ; division of three-digit by one-digit numbers ; the fractions $^5/_{100}$, $^{10}/_{100}$, $^{25}/_{100}$, $^{50}/_{100}$, etc. ; the kilogram and metre and their multiples and sub-multiples ; hour, minute and second ; mental arithmetic.

4th class: numeration and notation up to 1,000,000 ; addition and subtraction with whole numbers ; multiplication of a four-digit by a three- or four-digit number ; division of a six-digit by a two-digit number ; decimal and vulgar fractions, addition and subtraction with same; the metric system (revised and continued); mental arithmetic with the metric system and fractions; bookkeeping.

5th class: Arithmetic: numeration and notation up to 1,000,000,000; Roman numerals up to 50; addition, subtraction and multiplication with decimals; ratios and proportion; percentage; further work on weights and measures; household accounts. Geometry: cube, prism, cylinder, cone and sphere; surfaces, lines and angles; area of triangles, squares and rectangles; points; regular polygons (pentagon and hexagon); distance, weight, height and depth.

6th class: Arithmetic: revision of work done in previous classes; exercises on the four operations; exercises on vulgar and decimal fractions; invoices, reminders, cooperatives; practical problems of ratios and proportion, percentage and the metric system. Geometry: volume, surface (plane and curved), line, point; straight lines, measuring segments; horizontal, vertical, oblique, parallel; the plumb-line; area of triangles, squares, rectangles and parallelograms; circle and ellipse; area of regular pentagons and hexagons; construction of perpendiculars and parallels; length of the circumference, and area, of circles; surface area and volume of cubes, prisms and cylinders.

AIMS

The aim of the primary mathematics syllabus is to give pupils who wish to pursue their studies further the necessary basic training, and the remainder notions that will prove useful in everyday life.

METHODS

There are official recommendations on method. They lay special emphasis on the necessity of a concrete approach in forming a child's first notions of number, and on the usefulness of mental arithmetic at all levels. It is also deemed essential that teachers should insist on neatness in written work. All new ideas taught should be fixed and retained through numerous exercises. Teachers should try to ascertain the cause of any difficulties pupils may encounter. As far as problems are concerned, it is recommended that their content should be taken from the children's environment and always be within their experience, and that the various stages of a solution should be carefully studied.

In addition to the concrete objects used in the first class to acquire the first concepts of number, children learn to use a ruler for measuring, more especially in the school garden.

The textbooks used are those drawn up by the Ministry of Education.

ARGENTINA

From the reply sent by the Ministry of Education, covering all primary schools under the National Council of Education, but not necessarily those under the provincial authorities

PLACE OF MATHEMATICS IN THE CURRICULUM

The primary curriculum includes the teaching of mathematics *(matemáticas)* from the lower section of the 1st class (children of about six years old) onwards.

Six hours a week are devoted to such teaching in the first two classes, and five hours a week in the 3rd, 4th, 5th and 6th classes.

In all primary classes introduction to mathematics is made through the rudiments of arithmetic and geometry.

SYLLABUSES

The main points of the arithmetic syllabus are as follows :—

1st class, lower section: numeration, addition and subtraction ; practical knowledge of the litre, metre and kilogram, and of the principal units of time.

1st class, upper section: numeration ; multiplication and division (up to 5) ; practical knowledge of fractions (half, third, quarter and fifth) and multiples (double, triple, quadruple, quintuple) ; knowledge of the commonest coins.

2nd class: numeration ; multiplication and division (up to 10) ; concrete examples of fractions from sixths to tenths ; practical knowledge of measures and Argentinian coins and notes ; Roman notation up to 50, clock reading.

3rd class: numeration ; the four operations with whole numbers ; idea of a fraction ; general knowledge of simple fractions up to $^1/_9$ and of decimals to three places ; measures of length, capacity and weight (units, multiples and sub-multiples) ; units of time ; Roman notation up to 100.

4th class: general teaching of the properties of fractions ; multiplication and division of whole numbers and decimals ; the simple, direct and inverse rule of three ; simplification ; weights and measures of length and capacity ; equivalence and reduction ; measures of area, agricultural measures, old measures still in local use, measures of time ; yearly, monthly and daily rates of pay, bonuses ; simple interest, simple transactions ; Roman notation up to 1,000.

5th class: numeration (whole numbers and fractions) ; ordinary and decimal fractions ; divisibility ; metric system ; measures of volume and capacity ; weights ; measures of time ; currencies ; simple and compound rule of three ; simplification ; applications in simple problems of interest and discount.

6th class ; notions of specific weight, local examples ; notions of second and third power ; use of ideas of measures of area and volume ; the Argentinian monetary system ; foreign currencies, foreign trade ; rudiments of accounts used locally ; balance sheet and other common documents.

The main points of the geometry syllabus are as follows :—

1st class, lower section: notions of forms, volume and distance ; comparison of magnitudes ; tracing of figures, paper-folding.

1st class, upper section: recognition of geometrical forms (sphere, cylinder and cube) ; comparison of forms, volumes and distances ; measurement of magnitude ; the square and the circle ; drawing from models ; paper-folding and construction.

2nd class: recognition of geometrical solids (sphere, cube, cylinder, prism, cone and pyramid—face, base and arris) ; geometrical figures ; drawing and construction.

3rd class: straight and curved lines ; drawing perpendiculars and parallels freehand and with ruler, set-square and compass ; problems on triangles and quadrilaterals ; modelling and drawing of certain polyhedrons and round solids.

4th class: angles ; elements of triangles, polygons, perimeters and areas ; prisms and pyramids ; parallelepipeds in general.

5th class: development and construction ; relations between the circumference and its elements ; areas, volumes and capacity.

6th class: circular figures ; construction and development of round solids ; measures.

So far as the application of the above syllabuses is concerned, every item learnt must have a practical aim. Teachers should therefore support their teaching with practical examples, and exercises must be found in the actual surroundings. There should therefore be a relation between the exercises for mathematics and those for geography, natural science, handwork, etc.

Mathematics are of fundamental importance in Argentinian primary schools, but there are no yearly examinations in this (or any other) subject.

AIMS

The introduction to mathematics in Argentinian primary schools has a double aim. It is expected, on the one hand, to contribute to a child's intellectual training and development, and on the other to teach him those things which he must know. It should help, moreover, in attaining the general aims set for education in Argentina.

METHODS

The official syllabuses are not simple lists of the matters to be dealt with, but also contain suggestions to teachers. Mathematics should be taught in an essentially practical and concrete way. Theoretical extensions which yield no point or meaning for the children should therefore be avoided. Children will thus come to look on mathematics as a subject in keeping with their own interests.

The choice of teaching material is a matter for the teacher, who can make use of actual and graphic things and situations.

The use of educational games in kindergartens involves actions such as joining, taking away, repeating and dividing, which in essence are an introduction to mathematics through activity.

All textbooks other than those for reading are forbidden in Argentinian schools. The " cuaderno unico ", a comprehensive exercise-book, is thus the only means children have at their disposal for revision of mathematics lessons. They can, of course, consult textbooks, if they wish, even ones quite out of harmony with official aims.

MISCELLANEOUS

The syllabuses in force in Argentina were drawn up on the firm basis of what a child can really learn, and so avoid the " encyclopedic " approach which can be fruitless or even harmful.

AUSTRALIA

From the reply sent by the Commonwealth Office of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

The teaching of arithmetic begins at the very beginning of the primary school. This may be called the Kindergarten, Preparatory or Infant Division, or simply Grade I, depending on the State, the age at which a child begins school, and the type of school. The following generalizations of the position in the six States are probably true for the majority of children— :

State	Grade	Average Age of Admission
New South Wales	Kindergarten Class	5y. 6 m.
Victoria	Preparatory Stage of Grade I	5y. 6 m.
Queensland	Preparatory Class I	5y. 6 m.
South Australia	Kindergarten and Lower Grade I	5y. 6 m.
Western Australia	Infants Class	5y. 10m.
Tasmania	Grade I	6y. 0 m.

The approximate number of periods and hours per week devoted to arithmetic and the rudiments of mathematics in each primary class is as follows— :

State		No. of Periods	No. of Hours
New South Wales	First 2 years	6	3
	Later years	8	4
Victoria	1st year	6	3
	2nd year	7	3½
	3rd and 4th years	8	4
	Later years	9	4 ½
Queensland	Prep. Class	7	4 ½
	Grades 1 and 2	8	5 ½
	Later grades	8	5 ½ to 6 ½
South Australia	First 4 years	6	3
	5th year	7	3 ½
	6th and 7th	8	4

State		No. of Periods	No. of Hours
Western Australia	First 2 years	5	$2\,^1/_3$
	3rd and 4th years	6	$3\,^1/_6$
	5th and 6th years	5	$3\,^1/_3$
Tasmania	First 2 years	7	$3\,^1/_2$
	Later years	8	4

Except for Queensland, the figures are based on suggestions made in the printed courses of study, and many schools modify them. In Queensland they are based on replies from a number of schools based on practices in 1946 and 1947.

The rudiments of mathematics figure in the curricula under several headings. In New South Wales, the general term used is " mathematics ", but in the first and second kindergarten classes, the general term used is " number ". In Victoria, the term " number " is used up to Grade II, and " arithmetic " in Grades III to VI. In Queensland, the term " mathematics " is used. In South Australia, the term " number " is used up to Grade II, and the term " arithmetic " thereafter. In Western Australia the term " arithmetic " is used, and in Tasmania the term " mathematics ", covering both arithmetic and geometry.

The content differs very little, despite differences in name.

As regards geometry, in New South Wales and Tasmania the subject is included in the mathematics course from Class III and Grade III respectively. In Victoria, up to Grade VI, it is neither taught as a separate subject nor included in the arithmetic course, but some practical geometry is given in the art and handwork courses. In Queensland, practical geometry is included in the mathematics course from Grade II onwards. In South Australia, the only geometry taught appears in the arithmetic course from Grade V onwards. Ruler work, however, appears in Grade III and thereafter. In Western Australia, there is no separate subject of geometry and much less incidental work of a geometrical nature is done in the arithmetic course than in the other states.

SYLLABUSES

The main points of the primary syllabus in NEW SOUTH WALES are as follows :—

Class I: numeration and notation up to 50 ; addition and subtraction up to 10.

Class II: numeration and notation up to 100 ; addition and subtraction facts up to 20; 2- and 5-times multiplication tables, short multiplication ; recognition of coins to 1s.

Class III: numeration and notation up to 1,000; addition and subtraction facts up to 100; multiplication tables to 12-times; giving change to 10s., simple additions and subtractions of amounts of money; yard, foot, inch; telling time; reading calendar; pound, ounce; vulgar fractions $^1/_2$, $^1/_4$, $^1/_8$, $^1/_{12}$, $^1/_{10}$; making models of cube and upright prism; notion of angles; square and rectangle.

Class IV: numeration and notation up to 100,000; Roman numerals up to 1,000; one-column additions to seven addends; three-column additions with four addends; subtraction within the range; multiplication within the range by two-digit numbers; long division with remainder in 10,000 by two-digit numbers; problems involving one of the four rules; addition, subtraction, multiplication and division of amounts of money within £10; number of days in the week, in the months, in the year; number of weeks in the year; the months of the year; writing time a.m., p.m.; hundredweight, quarter and pound; gallon, quart and pint; one-step reduction of weights and measures; $^1/_3$, $^1/_5$, $^1/_6$; equivalent fractions; perimeter of square, rectangle and triangle; making models of pyramid, cylinder and cone; value of angles (30°, 45°, 60° and 90°); drawing triangles, given side and two angles; knowledge and use of the signs and terms $+$, $-$, $\times$, $\div$, $=$, plus, total, sum, minus, difference, product, divisor, equals, side and radius.

Class V: numeration and notation up to 1,000,000; one-column addition with ten addends, and four-column with five addends; subtraction within the range; multiplications by multipliers to 100; divisions by divisors to 100, quotient not exceeding 100; addition, subtraction, multiplication and division of amounts of money within £100; mile, chain, yard, foot, rod, link, inch; square inch, square foot, square yard; square chain, acre; pound, stone, hundredweight, ton; fractions of integral numbers, of money, of quantity; interrelations between vulgar and decimal fractions; decimal fractions up to hundredths, decimal point; area of rectangle, square and triangle; drawing parallels and circle; cylinder, pyramid, cone; meaning and use of terms multiplier, multiplicand, dividend, quotient, factor, base, circumference and diameter.

Class VI: numeration and notation above 1,000,000,000; multiplication and division within 1,000 million by three-digit numbers; addition, subtraction, multiplication, division, reduction of amounts of money within £1,000; cubic inch, cubic foot, cubic yard; problems involving the four operations with tables of weights and measures; the four rules with fractions; reduction of fractions to lowest terms; interrelations between vulgar fractions and per cent; decimal fractions to 1,000ths; decimal fraction as per cent; addition and subtraction with decimals to three places; multiplication and division of decimals to three places by a whole number;

volume of cube and rectangular solids ; per cent of sums and quantities ; one number as per cent of another, applications of per cent ; simple interest, profit and loss, discount ; properties of angles and sides of triangle ; use of protractor ; bisection of lines ; bisection of angles ; drawing right-angled, equilateral and isoceles triangles, given three sides, and two sides and angle ; sphere ; meaning and use of terms square, square root, base angles, altitude, perpendicular, horizontal, arc.

Victoria's arithmetic syllabus is briefly as follows :—

Preparatory Division: numeration and notation up to 10.

Grade I: numeration and notation up to 20 ; addition and subtraction facts to 10.

Grade II: numeration and notation up to 100 ; addition and subtraction facts up to 20 ; recognition of coins to 2s.

Grade III: numeration and notation up to 1,000 ; addition and subtraction facts to 100 ; 2- to 5-times multiplication tables ; multiplication within the range ; recognition of coins to £1 ; giving change to 2s ; foot, yard, inch ; days of the week and months of the year ; pound and ounce ; pint and quart ; introducing $^1/_2$, $^1/_4$, $^1/_3$, $^1/_6$, $^1/_{10}$, $^1/_5$.

Grade IV: numeration and notation up to 10,000 ; Roman numerals to 12 ; addition and subtraction within the range ; multiplication within 10,000 by two-digit numbers ; short division, dividend up to 10,000 ; problems involving addition, subtraction or multiplication ; recognition of current coins ; giving change from £1 ; addition, subtraction and multiplication of amounts of money within £5, one-step reductions ; inch, foot, yard, chain ; second, minute, hour, day ; year and leap year ; days in months ; telling time, reading calendar ; pint, quart and gallon ; one-step reduction of, and mental problems with, weights and measures ; introducing $^1/_8$, $^1/_{12}$, $^3/_4$; fractions of integral numbers ; knowledge of the angle ; drawing parallels ; recognizing and naming angles, square, rectangle ; meaning and use of signs and terms +, —, ×, ÷, =, plus, total, sum, minus, product, factor, equals.

Grade V: numeration and notation to 100,000 ; addition and subtraction within the range ; multiplication and division within 100,000 by two-digit numbers ; problems involving division ; addition, subtraction, multiplication and division of amounts of money within £500, two-step reductions and simple two-step problems ; mile, chain, yard ; number of weeks and of days in a year ; writing time a.m., p.m. ; pound, stone, quarter, hundredweight, ton ; three-step reductions with weights and measures, and problems involving not more than two operations ; fractions of money ;

simple graphs ; recognizing and naming circle, hexagon, cone ; meaning and use of the terms difference, multiplier, multiplicand, dividend, divisor, quotient, remainder.

Grade VI: numeration and notation to 1,000,000 ; addition, subtraction, multiplication and division within the range ; averages, H.C.F., L.C.M. ; aliquot parts of 1s. and £1 ; reductions with money, within limits of the four operations ; addition, subtraction, multiplication and division of amounts within £1,000 ; profit and loss ; foot, yard, mile, nautical mile, rod, pole, perch, link, chain ; square inch, square foot, square chain, acre, square yard ; fathom ; points ; short ton ; grain, pennyweight, ounce ; bushel ; problems with weights and measures within tables ; one quantity fraction of another ; the four rules with fractions, denominators to $^1/_{12}$, reduction to lowest terms ; interrelations between vulgar and decimal fractions and percent ; addition and subtraction with decimals to three places ; multiplication of decimals, product to four places ; division, quotient to two places ; perimeter of square, rectangle, triangle ; area of square and rectangle ; meaning and use of the terms minuend, subtrahend, prime factor, multiple, square root, side and diameter.

The main points of QUEENSLAND's arithmetic syllabus are briefly as follows :—

Preparatory Class I: learning to read and write numbers to 10 ; addition and subtraction facts to 10.

Preparatory Class II: numeration and notation to 20 ; addition and subtraction facts within the range ; measuring and drawing lines.

Grade I: numeration and notation up to 1,000 ; addition and subtraction facts to 100 ; inch, foot and yard ; number of days in a week ; months of the year ; telling time.

Grade II: numeration and notation up to 10,000 ; Roman numerals to 12 ; multiplication tables to 12-times ; short multiplication and short division ; recognition of coins to £1 ; minute, hour, day ; ounce and pound ; quart and pint ; $^1/_2$, $^1/_4$.

Grade III: numeration and notation up to 99,999 ; Roman numerals to 50 ; addition and subtraction within the range ; multiplication by three-digit numbers ; division by two-digit numbers ; averages ; problems involving addition, subtraction or multiplication ; giving change from £1 ; addition, subtraction, multiplication and division of amounts of money within £20, simple problems and two-step reductions ; foot, yard, chain, mile ; minute and second ; number of days and weeks in a year ; days in months ; gallon, pint and quart ; two-step reductions with weights and measures ; vulgar fractions $^1/_2$, $^1/_3$. . . . . . $^1/_{11}$, $^1/_{12}$; drawing vertical, horizontal and oblique lines.

Grade IV: numeration and notation to 9,999,999; Roman numerals to 100; division of seven-digit by three-digit numbers; prime numbers; introducing farthings; the four rules with amounts of money within £100; simple two-step problems and reductions within limits of the four operations; foot, yard, mile, chain, rod, link, furlong; leap year; writing time a.m., p.m.; pound, stone, quarter, hundredweight, ton; gallon and bushel; three-step reductions and the four operations with weights and measures; equivalent fractions; decimal notation to $^{1}/_{10}$th; perimeter of square and rectangle; drawing squares and rectangles to given dimensions; scales; recognizing and naming square, rectangle and right-angle.

Grade V: numeration and notation to 999,999,999; Roman numerals to 1,000; H.C.F., L.C.M., tests of divisibility; aliquot parts of 1s. and £1; profit and loss; square inch, square foot, square yard, square chain, acre, square rod; rood, perch, square mile, square link; problems with weights and measures within tables; addition and subtraction of fractions and mixed numbers; multiplication and division of fractions, reduction to lowest terms; interrelation between vulgar and decimal fractions; use of brackets; decimal point; the four rules with decimals; area of squares, rectangles and triangles; squares of numbers; properties of angles and sides of square and rectangle, estimating size of angles; drawing 45°, 60°, 90°, 120°, 135°, 150° angles.

Grade VI: short method of multiplication by 25; nautical mile; cubic inch, cubic foot, cubic yard; fathom; point; grain, pennyweight, ounce; ounce and pint; interrelation between vulgar fractions and percent; decimal fractions to millionths; areas of ceilings, floors, walls, borders of rectangle; square root by factors of whole numbers, fractions and decimals; per cent of sums and quantities; given per cent, finding quantity; simple interest; ratios; simple proportion; using scales on maps.

The main points of the arithmetic syllabus for SOUTH AUSTRALIA are as follows:—

Grade I: learning to read and write numbers to 20; addition and subtraction facts to 10.

Grade II: numeration and notation up to 100; 2- and 5-times multiplication tables, short multiplication within the range; recognition of coins to 1s.; inch, foot, yard; one week = seven days; twelve calendar months = one year; telling time.

Grade III: numeration and notation up to 1,000; Roman numerals to 12; addition and subtraction facts to 20; 3- to 7-times multiplication tables; short multiplication and division; recognizing coins to £1; second, minute, hour, day; pound and ounce; pint, quart, gallon; measuring lines.

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Grade IV: numeration and notation to 10,000; addition of four addends, total to 1,000; addition of two addends, total to 10,000; subtraction, minuend to 1,000, subtrahend to 999; short multiplication and short division; problems involving one of the four rules; addition, subtraction, multiplication and division of amounts of money within £10; foot, yard, chain; pound and stone; easy problems with weights and measures; introducing $^1/_2$, $^1/_4$; drawing vertical, horizontal and oblique lines.

Grade V: numeration and notation up to 100,000; addition of four addends, total to 100,000; subtraction, minuend to 100,000; multiplication and division by two-digit numbers; addition and subtraction of amounts of money within £100; multiplication of sums to £20, by not more than 12; foot, yard, chain, mile; number of days in a year, in a leap year, in the months; pound, quarter, hundredweight; three-step reductions with money, weights and measures; problems within tables; $^1/_2$, $^1/_8$, $^3/_4$, $^2/_3$; properties of sides and angles of square and rectangle; drawing squares and rectangles according to given dimensions.

Grade VI: numeration and notation to 999,999,999; multiplication within one million by three-digit numbers; aliquot parts of 1s.; reductions to find unit cost price; addition and subtraction of sums within £1,000; multiplication of sums up to £10 by two-digit numbers; divisions with dividend to £200 and two-digit divisor; angular measure; pound, hundredweight, ton; $^1/_9$, $^1/_{10}$, $^1/_{11}$, $^1/_{12}$; the four rules with fractions; decimal fractions to 1,000ths; decimal fraction as vulgar fraction; the four rules with decimals; perimeter of square, rectangle and triangle; drawing 30°, 45°, 60°, 120° angles; drawing equilateral triangles.

Grade VII: averages to ten items of two denominations; aliquot parts of £1; multiplication of sums up to £100 by three-digit numbers; division of a dividend to £1,000 by a two-digit divisor; profit and loss; square inch, square foot, square yard, square chain, acre, square mile; cubic inch, cubic foot, cubic yard; the four operations on three-denomination weights and measures, with two-digit multipliers and divisors of not more than two digits; fractions of money, one quantity fraction of another; the four rules with mixed numbers; decimal fractions as per cent; area of square, rectangle, triangle; volume of cube and rectangular solids; areas of ceilings, floors and walls; relation between vulgar fractions, decimal fractions and per cent; per cent of sums and quantities; simple interest with whole numbers and whole years, three months, six months, nine months; general discounts; commission; properties of angles and sides of triangle; use of protractor; drawing triangles to given dimensions.

In WESTERN AUSTRALIA, the arithmetic syllabus is briefly as follows :—

Infant class: learning to read and write numbers to 100 ; recognition of coins to 1s.

Class I: addition and subtraction facts to 10 ; 2- to 5-times multiplication tables ; multiplication and division within number range ; recognition of coins to 2s. ; inch, foot, yard ; seven days = one week.

Class II: numeration and notation to 1,000 ; addition and subtraction facts to 20 ; 3- to 7-times tables ; multiplication and division within tables ; recognition of coins to £1 ; twenty-four hours = one day ; pound and ounce ; pint and quart ; $^{1}/_{2}$, $^{1}/_{4}$.

Class III: numeration and notation up to 99,999 ; addition and subtraction within range ; multiplication of three-digit by two-digit numbers ; short division ; pence and shillings, one-step reductions ; addition, subtraction and multiplication of sums within £10 ; division of sums to £1 by divisor to 6 ; simple problems with money ; foot, yard, chain ; second, minute, hour ; 52 weeks = one year ; telling time ; ounce, pound, stone ; pint, quart, gallon ; one-step reductions and easy problems with weights and measures ; introducing $^{3}/_{4}$; fractions of integral numbers ; recognizing and naming cylinder, cone, sphere ; meaning and use of signs and terms +, —, ×, ÷, =, plus, total, sum, minus, difference, remainder.

Class IV: numeration and notation up to 9,999,999 ; addition, no addend to exceed four places, maximum to be five addends ; subtraction, minuend to 999,999, subtrahend to five figures ; multiplication of three-digit by three-digit numbers ; division within seven figures by two figures ; addition of sums, four addends, each under £10 ; subtraction of sums of all types ; multiplication of sums under £10 by easy factors ; division of sums to £100 by divisor to 12 ; yard, chain, mile ; pound, quarter, hundredweight, ton ; three-step reductions with money and two-step reductions with weights and measures ; introducing $^{1}/_{3}$ and $^{2}/_{3}$; perimeter of square and rectangle ; meaning and use of terms dividend, divisor, quotient.

Class V: numeration and notation up to 999,999,999 ; multiplication of four-digit by four-digit numbers ; division by divisor to four figures, quotient to three figures ; multiplication of sums up to £10 by two-digit numbers ; division of sums by two figures ; square inch, square foot, square yard, square chain, acre ; problems with weights and measures within tables ; $^{1}/_{5}$, $^{1}/_{6}$. . . . $^{1}/_{11}$, $^{1}/_{12}$; one quantity fraction of another ; the four rules with fractions and mixed numbers, denominators to 12 ; interrelation between vulgar fractions and per cent ; perimeter of triangle ; area of square and rectangle ; per cent of whole numbers and of sums of money ; one number as per cent of another ; meaning and use of terms minuend, product, factor.

Class VI: general averages; aliquot parts of £1; cubic inch, cubic foot, cubic yard; three-step reductions with measures and four-step reductions with weights; reduction of fractions to lowest terms; decimal notation to 1,000ths; interrelations between decimal fractions, vulgar fractions and percent; the four rules with decimals, results to two places; area of triangle; volume of rectangular solids, cubes and cylinders; areas of ceilings, floors, walls; per cent of sums and quantities; simple interest with whole numbers, and whole years, three months, six months and nine months; general discounts; meaning and use of terms multiplier, square, side, base, circumference, diameter, radius, π.

TASMANIA's arithmetic syllabus is briefly as follows:—

Grade I: learning to read and write numbers to 100; addition and subtraction facts up to 20; 2- and 5-times multiplication tables; recognition of coins to 1s.; inch, foot; measuring and drawing lines.

Grade II: numeration and notation to 1,000; addition and subtraction facts to 100; 3- to 7-times multiplication tables; short multiplication and division within number range and tables; recognition of coins to £1; foot, yard; minute, hour, day, week, fortnight; telling time; $^1/_2$, $^1/_4$.

Grade III: numeration and notation to 10,000; Roman numerals to 12; addition and subtraction within range; multiplication by two-digit numbers; short division; short multiplication methods by 5, 50, 99, 100; recognition of current coins; giving change from £1; addition, subtraction and multiplication of sums within £5; foot, yard, chain, mile; second, minute; weeks in a year; days in months, reading calendar, recording date, writing time a.m. and p.m.; ounce and pound; pint, quart, gallon; temperature scales; one-step reductions and mental problems with weights and mesures; $^1/_3$, $^1/_6$, $^1/_8$, $^1/_{12}$, $^3/_4$, $^2/_3$, $^1/_5$, $^1/_7$, $^1/_9$, $^1/_{10}$, $^1/_{11}$; fractions of integral numbers; perimeter of square and rectangle; recognizing and naming triangles.

Grade IV: numeration and notation up to 100,000; Roman numerals to 20; addition and subtraction within the range; multiplication by two-digit numbers; simple average; short multiplication method by 25; addition, subtraction and multiplication of sums within £500; division of sums by numbers to 12; simple two-step problems and two-step reductions with money; foot, yard, rod, pole, perch, link, chain; number of days in a year; pound, stone, quarter, hundredweight, ton; three-step reductions with weights and measures (with length, four steps); problems with weights and measures within tables; fractions of quantities and of money; recognizing and naming rectangle, rhombus, equilateral and isoceles triangle.

Grade V: numeration and notation to 100,000,000; Roman numerals completed; addition, subtraction, multiplication and division within 1,000,000 ; introducing farthing ; aliquot part of 1s. and of £1 ; addition and subtraction of sums within £1,000 ; multiplication and division of sums within £1,000 by 2 digits ; reduction of money within limits of the four operations ; profit and loss ; chain, furlong, mile ; square inch, square foot, square yard, square chain, acre ; fathom ; point ; pound and short ton ; gallon, peck, bushel ; the four operations with weights and measures, multipliers and divisors to two figures ; mental addition and subtraction of fractions ; use of brackets ; decimal notation to 10ths ; decimal fraction as vulgar fraction ; perimeter and area of square and rectangle ; perimeter of triangle ; properties of angles and sides of square and rectangle ; recognizing and naming acute, obtuse and right angles, parellelogram, trapezium, right-angled triangle, pentagon, hexagon, octagon ; meaning and use of terms square, diagonal, axis, circumference, diameter.

Grade VI: multiplication within one million by three figures ; general average ; H.C.F., L.C.M. ; multiplication of money within £1,000 ; practice in short methods with money ; square yard, square rod, perch, rood, acre, square mile ; cubic inch, cubic foot, cubic yard, gallon ; second, minute degree, right angle ; fractions to 16ths and 20ths and 24ths ; the four rules with fractions and mixed numbers, reduction to lowest terms ; addition, subtraction, multiplication and division of decimals to three places ; area of triangle and circle ; volume of rectangular solids and cube ; areas of ceilings, floors, walls, borders of rectangle ; relation of vulgar fractions, decimal fractions and per cent ; per cent of sums and quantities ; one number as per cent of another ; simple interest, principal a whole number ; given cost price and selling price, finding gain or loss per-cent ; given cost price and gain or loss per cent, finding selling price ; general discounts ; commission ; rates and taxes ; simple proportion ; meaning and use of signs and terms $\surd$, minuend, subtrahend, multiplicand, prime factor, multiple, square root, side, base, base angles, apex, altitude, perpendicular, horizontal, radius, arc, chord, segment, equidistant.

In all States, wherever possible, the courses recommend that the instruction should deal with concrete and practical materials, e.g. in fractions, weights and measures, mensuration, etc. It is, however, regarded as equally important that the pupils should be able to manipulate numbers in the abstract. Everywhere, project work in suitable topics is recommended. Some incidental work is done in these deliberately. Incidental work of a minor nature is inevitable in dealing with any numerical material in subjects other than arithmetic.

Final examinations in mathematics are held in the schools of all Australian States in the middle and last years of the primary schools. Not all schools, however, require a pass in mathematics before a child is promoted to the next grade.

Failure in mathematics does not apparently debar a pupil from transfer to secondary education in any state, though success in it may in all States affect the choice of school to which the pupil transfers, or the type of course undertaken in the secondary school.

AIMS

Although the six States express their aims in different ways, they broadly agree that arithmetic a) helps a child to form clear ideas about numbers, quantities, time and space, and their relations ; b) makes these ideas useful by exercising him in practical calculations based on them ; and c) enables him to use the skill so developed intelligently, accurately and speedily for working out everyday problems within his experience.

METHODS

In all States, there are official suggestions concerning the teaching of mathematics.

In the early years, number is introduced through games and activities of an informal nature. Regular and systematic drills are stressed, particularly in the number facts. Adaptation of the course to individual abilities is also strongly recommended. Logical sequence of topics is ensured by the arrangement of the course of study, from which few teachers depart radically. It is uncommon for a method of instruction or treatment of a topic to be prescribed, considerable freedom being given to teachers to choose their own methods.

The blackboard and the textbook are the two teaching aids most frequently used. Except in emergency circumstances, it is safe to say that every teacher has blackboard and chalk with which to demonstrate and illustrate, and every pupil a textbook containing examples suited to his level of skill, and exercise books and writing materials for his calculations.

Other general aids used (in approximate order of frequency) are squared paper (for fractions, graphs), models, paper strips, games, counters and cards. Materials such as local price lists, newspaper advertisements and reports, trade catalogues, and time-tables, are also used by some teachers.

Special aids most frequently used, particularly at the upper levels, are footrules and yardsticks, clocks and coins, both real and imitation, calendars, scales and weights, capacity measures, drawing instruments, thermometers and barometers.

Victoria prepares, publishes and provides illustrated textbooks for Grades III to VIII, with a special textbook for rural schools. Queensland has similar publications, not illustrated, for Grades III to

V. Tasmania has similar publications, illustrated, for Grades II to VII. In the other States, teachers are free to select their own textbooks from amongst those supplied by commercial publishers.

The " Departmental " textbooks are usually prepared by committees of inspectors and practising teachers, the " commercial " ones by one or two authors who may be inspectors, lecturers or teachers. In both cases, textbooks are prepared to run parallel to the official course of study, and give plenty of examples on each topic therein prescribed or suggested. In some instances, they include practical aids such as diagrams to illustrate certain processes, e.g., fractions, mensuration and reduction.

MISCELLANEOUS

Courses of study are under fairly constant review, and recently new courses have appeared in South Australia (1945 and 1947) and Queensland (1947). Curriculum committees are at work in Western Australia and New South Wales, and there are curriculum officers in Tasmania and Victoria who keep courses under constant review.

The two most recent works on the teaching of mathematics in primary schools are MELDRUM, TURNER AND BATES' " The Teaching of Arithmetic ", and the VICTORIA EDUCATION DEPARTMENT'S " The Method of Teaching Arithmetic. "

The notes on the South Australian and Queensland Courses (published in November 1947) contain many suggestions on teaching practice. More extensive notes are found in the Western Australian Course (1936) and the New South Wales Course (1941).

AUSTRIA

From the reply sent by the Ministry of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

The subject called *Rechnen und Raumlehre*—arithmetic and geometry—in the curriculum, is taught from the first primary class (children of six years of age) onwards. Four hours a week are devoted to it in the first four classes and five hours a week after that, making in all about a fifth of the time passed at school.

In the first two classes it is through actions such as handling, showing, removing, folding, modelling and cutting out that a child forms and organises his notions of space. Geometry is taught in a more systematic way in and after the third class, but continues to be correlated with things and situations within the children's immediate experience.

Arithmetic and geometry are taught as separate but correlated subjects from the fifth class onwards.

SYLLABUSES

The principal matters dealt with are as follows :—

1st class : Arithmetic : notion of number ; numeration up to 100 ; addition and subtraction ; multiplication and division by 2, 4 and 3, of numbers less than 20 ; notions of measures (weight, money, etc.). Geometry : elementary notions.

2nd class : Arithmetic : notation up to 100 ; addition and subtraction ; simple multiplication ; division (half, third, quarter) ; multiplication tables. Geometry : as in the first class.

3rd class : Arithmetic : numeration up to 1,000 ; exercises with multiplication tables ; written problems ; fractions (half, quarter, eighth, tenth, fifth). Geometry : description of planes and volumes.

4th class : Arithmetic : exercises ; numeration up to 1,000,000 ; decimal and simple fractions ; written and mental exercises on the four rules. Geometry : as in the 3rd class.

5th class: Arithmetic: continuation with numbers; the decimal system; the four operations with whole numbers and decimal and simple fractions. Geometry: making, naming and principal characteristics of simple solids; relations in the rectangle, square, cube, etc; use of set-square, compass, etc.

6th class: Arithmetic: exercises chiefly on decimal and simple fractions; interest. Geometry: important solids; relationships in the rectangle, triangle, regular polygons and cubes.

7th class: Arithmetic: as in the 6th class, and exercises in connection with various occupations. Geometry: relationships in volumes and planes (Pythagoras, tables of powers and roots, similarity, surveying).

In all classes chief place is in general given to practical exercises. Arithmetic and geometry, moreover, may be incidentally developed in connection with lessons on knowledge of the country, handicrafts, geography, natural science, drawing and so on.

Both in regard to promotion and to the award of the school leaving certificate, the utmost importance is attached to the results a child obtains in arithmetic and geometry.

AIMS

It is stated in the curriculum that the teaching of arithmetic and geometry should lead a child to grasp the spatial and quantitative aspects of his surroundings, and at the same time to acquire a mental discipline. The knowledge so gained should enable him to use the four rules with whole numbers and decimal and simple fractions, and to solve simple everyday problems. He should also have basic notions of geometry.

METHODS

Teachers in Austria are entirely free as to their choice of methods, but almost without exception they use activity methods and confirm what they teach with exercises. Subjects are always adapted to the mental level of the children.

As to the teaching aids used, mention should be made of the ball-frame and the Born-Kuehnel pictures. Counting sticks and beans are also used.

The arithmetic textbooks were drawn up by specialists, in some cases with the help of study-groups organised by the teachers' associations. All textbooks for use in schools must be approved by the Ministry of Education.

All textbooks now in use contain simple explanations with examples, and a great variety of exercises.

MISCELLANEOUS

Two books on the teaching of mathematics in primary schools appeared recently. They are Konrad Falk's " Ein Weg ins Reich der Zahlen " (Vienna, Verlag für Jugend und Volk, 1948), and the same author's " Pflege der Raumanschauung " (Vienna, Oesterreichischer Bundesverlag, 1948).

BELGIUM

From the reply sent by the Ministry of Education

STATE INSTITUTE OF EDUCATION BANIPUR

PLACE OF MATHEMATICS IN THE CURRICULUM

Under the name of *pré-calcul* (pre-reckoning) or *initiation au calcul* (rudiments of reckoning), introduction to mathematics begins in Belgium at the age of three or four years in the quite special atmosphere of the nursery-infant classes. No more is attempted than to suggest an arithmetical way of thinking and so help in the birth of a mental capacity whose growth is a particularly slow one. Notions of number, based on the ability to make comparisons, develop gradually through exercises in observation. Thought and language exercises provide opportunity to make the children familiar with the subtle and complicated general terms of quantity. Full advantage is taken of a child's interest in collecting things, so as to train him early to count; scales of weights are established; various exercises are given in choosing, classifying, concrete analysis, measurement, drawing, synthesis.

Reckoning or arithmetic proper begins on a child's arrival at the primary school, at the age of six years.

The official curriculum, however, does not lay down set periods for the subject in the first grade (children from six to eight years of age), but treats it as only one aspect of the general school activity of which it forms part. Teachers nevertheless give the greatest care and attention to introducing mathematics and on an average devote one hour a day to it.

For the second grade (children from eight to ten years of age) the curriculum stipulates six hours a week for the teaching of arithmetic.

For the third grade (children from ten to twelve years of age) the curriculum calls for only five hours a week, but in many schools the figure is maintained at six.

Geometry is never taught as a separate subject in Belgian primary schools, but notions of shape—closely linked to those of number and measurement—form an integral part of arithmetic in all classes. The purpose of the sense-training given in the nursery-infant schools (up to six years) is to help a child to evolve by distinguishing and separating form from colour, size and material. Between six and eight years of age a child acquires a conception of form through a gradual process of abstraction. From nine onwards he begins to make use of simple instruments (ruler, set-square, compass) and gains proficiency ; he formulates abstract ideas of form, area and volume and discovers the properties of geometrical figures and solids. It is always a question, however, of an inductive and constructive geometry.

Syllabuses

The syllabuses are given in the " Plan d'études officiel " of 1936.

1st grade (6-8 years). The syllabus makes a distinction between abstract items of knowledge, few in number, and the very numerous items arising from concrete practical experience. Counting and manipulating concrete quantities up to 100 ; at a purely mental level, addition and subtraction with abstract numbers up to 20, the second term of the operation being limited to 9 ; in measurement, the teacher is expected to accustom the children to making controlled (verified and compared) estimates of 1 to 5, doubles, halves and quarters ; magnitudes to be estimated include lengths, heights, weights and capacities, natural measures being first used ; measurement of time ; a sense of periods (week, hour, half-hour, quarter-hour, day, half-day, days of the week, yesterday, tomorrow) ; notions (practical, not verbal) of the forms of rectangles and squares and, in the 2nd year, of triangles.

2nd grade (8-10 years). A. Forming an arithmetical habit of thought :— numeration of whole and decimal numbers ; acquiring, practice and use of new tools—mental and written arithmetic ; accuracy and understanding with regard to the meaning and mechanism of the operations ; increasing accuracy in expressing measurements ; appearance and confirmation of the relationship between the whole and its parts. B. Knowledge :— numeration and notation up to 10,000 ; relationships between the various units ; relationships between units, and multiples and sub-multiples ; commoner ways of doing ready reckoning and mental arithmetic ; equivalence between certain vulgar and certain decimal fractions ; addition and subtraction of fractions with the same denominator ; multiplication and division of fractions by numbers up to 9 (operating on the numerator). C. Mechanical skills :— speedy multiplication by 11, 9, 5, 50 ; making a number 10-, 100- or 1,000-times smaller or bigger ; multiplication and division tables ; addition and subtraction of whole and decimal numbers ; multiplication and division of whole numbers (divisor limited to two digits) ; $^1/_2 = 0.5$, $^1/_4 = 0.25$, $^1/_5 = 0.20$. D. Notions :— principles and rules of numeration ; certain more difficult processes of mental arithmetic ; examples of multiplication and division of decimal numbers ; proofs of, and comparison between, the operations ; make-up of fractions.

3rd grade (10-12 years). The syllabus studiously avoids all useless complications, all purely theoretical speculation. It explicitly condemns involved sums on interest, the demonstration of the operations as applied to fractions, the more difficult rules of three, the theory of numbers and the abstract study of their properties. Its aim is an essentially practical and utilitarian one, and it completes the knowledge acquired in the previous classes. Decimal numeration ; principles of the metric system ; meaning of the four operations ; the four operations with fractions ; practical problems ; elementary geometrical forms (drawing, construction and calculation of areas and volumes).

At all primary levels there is a desire in spiritual activity never to lose touch with the concrete realities, and this leads to giving an important place to practical work, such as measuring magnitudes, getting facts about everyday living conditions, learning through using a sand-tray, drawing small plans to scale, making graphs, and solving real-life problems with plan, elevation and section as the only data given.

Properly understood, an introduction to geography calls for mathematical activities, which have the advantage of a motive : estimating and verifying distances and magnitudes, drawing maps to scale, interpreting graphs, calculating averages, reading maps.

The teaching of natural science, based on observation and experiment, provides frequent opportunity for using arithmetic : school gardening, the " living-things corner ", elementary physics, botany and zoology, and observation over a period.

The introduction of new school techniques, moreover, frequently provides the impulse to solve certain problems : printing, the school cooperative, excursions.

The local district examination at the end of the sixth primary year affirms the importance of arithmetic by giving 30% of the total marks to the subject. The type of questions set is in conformity with the aims and spirit of the methods now in use in Belgian schools.

AIMS

The " Plan d'études " of 1936, mentioned above, defines the aims of the teaching of mathematics and suggests their relative importance ; they are to awaken an arithmetical way of thinking in the nursery-infant classes and the first grade (6-8 years) of the primary school, and impart mechanical and technical skills, knowledge, and above all a mental discipline.

The " Plan d'études " seeks to ensure a union between knowledge and the way in which it is acquired, a union leading to a simultaneous " in-forming " and " forming " of a child's mind.

METHODS

The official syllabuses contain recommendations as to methods. The method put forward is a practical and functional one, insofar as it treats arithmetic, not as an end, but as a necessary instrument of individual and social conduct, as a means of solving problems arising from everyday life. It calls on teachers to create a favourable atmosphere by making their class a place where children will naturally lead an intensely social existence. It is a method, moreover, based on the principle of " integration ". To have interest and incentive, arithmetic must be taught in connection with other subjects, in an " integrated " form, i.e., through certain common nuclei of interest. Desirable though it may be in the first two grades, however, " integration " must be tactfully and reasonably employed in the 3rd grade. At this stage it would be dangerous to be over-conscientious and systematic, and " integrate " all subjects into one. Arithmetic is a progressive science and would lend itself ill to a new formalism of such a kind.

Official instructions also demand the acquisition of mechanical skills in arithmetic. Such skills, they assert, are a routine and automatic aspect of arithmetic, which has to be accepted. Teachers must ensure that such skills lead to greater freedom for the mind, and that they are put at the service of an ability to advance.

Old-fashioned teaching aids were often conceived by grown-ups with commercial rather than educational aims in view, and are fast disappearing from the classroom (ball-frames, arithmometers, bowls, counting sticks, constructional games). In nursery-infant classes hardly any expensive or complicated apparatus is now to be found, but only beads, paper, scissors, clay, crayons, and various objects found on walks. At the primary school the best and most efficient material is provided and made by the children themselves, as and when they explore their surroundings or as the need arises. The young children in the first grade get plenty of practice with material in constant change : horses at the fair, posts in railings and fences, beans in the pod, trees along the road, leaves on a branch. Special material consisting of " domino cards " (giving spatial pictures of number groups) serves as a bridge between concrete and pure arithmetic. Pupils also feel the need to make certain measuring instruments themselves—the metre, decimetre, cubic metre, set-square, balance. The pupils themselves can also bring things to make a collection of measures of capacity, in the course of their activity at school—the household pail (a decalitre), a vinegar bottle (a litre), a bottle from the chemist's (a decilitre), a scent bottle (a centilitre), a medicine bottle (a millilitre). The sand-tray is used in a good many classes ; it helps greatly in introducing geography and is a means of teaching a host of arithmetical ideas in a living form.

As indicated in official instructions, the initial stages of arithmetic consist in activity, an activity of play and not of thought. As a result the " play-way " has taken complete possession of nursery-infant classes, and has a strong foothold in the lower primary classes. The so-called " educational " games, however, which have greatly increased in number in recent years, are often badly used. They are sometimes of a quite artificial kind and thus have no practical or functional value whatsoever. For a child play is work, something he does himself; it often takes the form of imitating adult activities; it should therefore be both subjective and objective. One can find some highly interesting games in many classes of very young children: grocer games, postman and baker games, skittles, dominoes, draughts, noughts and crosses, fishing, games with electricity, and various kinds of competitive games.

True activity teaching does not lend itself readily to the use of textbooks or set problems. Books offer no suitable material for a teaching which is in close connection with the environment and real life. Observing and estimating real things, consulting catalogues, time-tables and price-lists, are much more attractive and interesting than the standardised unchanging data given in textbooks. Lists of definitions, rules and principles have no place in a programme which outlaws verbalism. If absolutely necessary, certain books imbued with the spirit of the " Plan d'études " might be allowed, but they will no longer come as dictatorial guides, to be followed page by page, but merely as useful auxiliaries affording variety in subject-matter and revision exercises.

It is unfortunately true that all too many classes continue to use the mediocre type of book whose half-hearted and superficial attempts at reform are nullified by a confused mass of abstract and supposedly graded exercises and in whose problems—despite their brave endeavour to remain in contact with reality—the blood has never flowed.

Being more adaptable than textbooks, various aids are coming more and more into favour among teachers—arithmetic cards (for functional work, revision, acquiring mechanical skills, and problems), exercise-books and pictures for teacher's and pupil's introduction, systematising and synthesising, problems arising from the environment or life itself (estimates, a scheme for draining or distributing water, building something, preparing a meal, estimating complicated costs at the end of a certain period of time, or quantities needed).

Miscellaneous

No fundamental change is now contemplated in the teaching of arithmetic in Belgian primary schools. All effort is being concentrated on a general thoroughgoing application of the principles and syllabus of the " Plan d'études " of 1936, an important operation which will take many more years to fulfil.

In the year under review the university advisory committee on education began an important inquiry into the difficulties met with in teaching arithmetic in primary schools. The Department will possibly make use of the results of this inquiry, and issue additional instructions to teachers.

The Department of Education put the question of the teaching of arithmetic on the agenda of the " information and refresher week " held at Easter 1948 and attended by some four hundred and fifty teachers. It also organised two exhibitions on the same subject, one at Liége in December 1948, and the other at Ghent in February 1949, which attracted thousands of visitors.

Few outstanding works have appeared recently on the method of arithmetic, with the exception of L. Jeunehomme's " Pédagogie en cours " (Liége, Desoer), and E. Natalis's " De l'empirisme au raisonnement logique " (Liége, Dessain).

BOLIVIA

From the reply sent by the Ministry of Education, Arts and Native Affairs

PLACE OF MATHEMATICS IN THE CURRICULUM

A subject called *aritmética y geometria* (arithmetic and geometry) is taught in Bolivian primary schools from the 1st year (children of seven years old) onwards. Five hours a week (four for arithmetic and one for geometry) are devoted to it in the 1st, 2nd, 5th and 6th classes, and four hours a week (three for arithmetic and one for geometry) in the 3rd and 4th classes.

Geometry is not given as a separate subject, but in correlation with arithmetic and the metric system.

SYLLABUSES

The principal points of the arithmetic and geometry syllabus are as follows :—

1st year: notions of number, formation of numbers ; numbers up to 5, then 10, then 15, then 20 ; half, quarter ; operations, simple problems and exercises ; mental arithmetic ; concrete notions of natural measures and commoner units of the metric system ; concrete notions of natural forms.

2nd year: notions of number, formation of numbers ; units, tens and hundreds ; half, quarter, eighth ; operations, simple problems and exercises ; mental arithmetic ; common measures and forms ; concrete teaching of natural measures and the metric system as in the 1st year.

3rd year: formation and knowledge of numbers ; progressive series ; units, tens, hundreds and thousands ; operations (one-digit multipliers and divisors) ; numerical and graphical exercises ; simple problems involving reasoning ; mental arithmetic ; geometrical solids ; useful metric measures.

4th year: knowledge and formation of numbers up to 10,000 ; operations, simple problems involving reasoning ; mental arithmetic ;

construction ; areas (rectangle, square, triangle, rhombus) and volumes (cube, parallelepiped) ; simple problems ; useful metric measures ; practical problems and exercises.

5th year : formation of numbers up to 100,000 ; operations and problems ; mental arithmetic ; construction ; surfaces (rhombus, trapezium, regular polygons and circle) ; practical problems and exercises ; volume ; unitary method and practical problems (simple interest, simple rule of three) ; metric measures, practical exercises, problems.

6th year : problems involving reasoning ; oral and written exercises ; mental arithmetic ; unitary method ; problems with simple and compound rule of three ; interest ; metric units ; oral and written problems ; geometry : construction ; problems and exercises on practical applications of geometry ; areas and volumes in relation to handwork, feminine handicrafts, drawing.

In the middle and upper primary classes, knowledge of fractions should be limited to general notions, their proper study beginning only in the lower section of the secondary school.

In all classes what is learnt is applied through practical exercises. Mathematical ideas are also used in teaching other subjects ; this is especially the case in geography, in connection with questions of altitude, area, population and densities.

Mathematics being deemed an essential tool, children must have mastered the mathematical items in their class syllabus in order to be promoted.

Aims

The aim of teaching mathematics in Bolivian primary schools is to aid intellectual development (reasoning power, speed, memory, attention) and to enable children to solve everyday problems.

Methods

Suggestions as to methods of arithmetic and notions of mathematics are contained in the official syllabuses. They are preceded by the following general remarks :—

a) The well-known educational principles should be applied in teaching : proceeding from the simple to the complex, from the easy to the relatively difficult, from the concrete and mechanical to reasoning and abstract analysis. In mathematics, therefore, broad and concrete methods should be employed in the lower classes, leading to a logical approach in the upper classes. Introduction, investigation and a genetic approach should be used at all levels.

b) The teaching of arithmetic and geometry should be easily understandable, adapted to the children's mental development, and not formal or dogmatic in character. Interest is the ground of learning. Teachers should therefore use clear and precise language, and constantly seek to stimulate their pupils. The subject should not be presented as a difficult one which only the gifted can hope to master ; children's prejudices about the terrible difficulty of arithmetic should be dispelled. Good methods can make teaching simpler. Any subject becomes disagreeable, if from the very beginning it is presented as bristling with difficulties.

c) Teaching aspiring to be practical, broad and experimental, should make use of the " heuristic " method of personal discovery. With varied material, a child can observe, manipulate, experiment, analyse, discover, formulate, define and generalise for himself. The teacher should thus confine himself as a rule to guiding, correcting and explaining ; when absolutely necessary, of course, he should demonstrate, and the child should then repeat correctly what has been done. Short exercises, frequent and varied, will lead to an accurate and speedy use of numbers. On occasion, mutual aid among the children is of value.

d) Arithmetic, the metric system and geometry being members of the same family, they should be taught in association with each other, and in connection with real events in the children's environment and with other subjects in the curriculum. Purely abstract, mechanical, mnemonic and dogmatic procedures are quite worthless.

e) Teaching should be graded, well arranged, adapted to the children's intellectual stage, and limited to a given level of knowledge. A child should have mastered what he has been taught before going on to new aspects of the subject, i.e., there should be no sudden breaks in the sequence of mathematical laws and principles. In the lower classes, lessons should be of a general kind, and in the upper classes, reasoned and appealing to the inductive and deductive faculties. When called for, however, a return should be made to a broad approach again, with practical examples and applications. In all cases, demonstration and study should precede definitions, formulations and rules. Teachers, moreover, should notice the varying intellectual make-up of their pupils, make use of analogies, and quite often follow in humanity's evolutionary path. What is taught should be of social value.

f) Problems should be articulated with the various items of work done, and take the form of projects in connection with environmental needs. They should be graded in difficulty, concrete at the beginning, and devoid of complications and catches. Their data should be clear, precise, linked with real life, and not artificial or overtechnical.

g) Besides being useful in everyday affairs, mental arithmetic helps children to do written arithmetic and develops their power of abstract reasoning. The difficulties of learning to do it should be graded ; accuracy should at all times be insisted upon ; speed will come gradually. It is not advisable to use numbers which are too big. Answers should be found by breaking down bigger numbers into smaller ones (*e.g.*, $3{,}450 \times 6 = 3{,}000 \times 6$, plus 400×6, plus 50×6). Practice in mental arithmetic should be given frequently for short periods—the lesson in written arithmetic may well begin with a few minutes mental arithmetic.

h) Problems should not only be of immediate value, but should also help children to think more logically and teach them to find the solutions to social problems.

i) In the lower classes, examples of geometrical forms should be found among objects in common usage ; oranges represent spheres, boxes cubes, crayons cylinders. In geometry it is essential to teach children to use instruments, and to apply what they have learnt to real life (measuring the playground and school garden, drawing simple plans and maps, calculating volumes, making useful things). A broad, general approach in elementary geometry assists the powers of perception, association and abstraction to develop, as the fundamental notions are being acquired ; study at later, more advanced stages then becomes less arduous.

j) Knowledge of weights and measures should be essentially practical. It should be acquired through weighing and measuring, and making comparisons, calculations and checks, in order to solve real problems. Measures not in actual use should be ignored.

k) Setting special tasks for pupils who show exceptional ability in mathematics is to be recommended. Pupils who are backward, on the other hand, should be given a whole series of exercises to work out.

Educational games, common objects, real measurements, known forms and, on occasion, gymnastic and rhythmic exercises—all these are thus turned to good account in the teaching of mathematics.

Textbooks and printed exercises are not used. Only teachers have access to works of reference. Each child has his own notebooks.

BULGARIA

From the reply sent by the Ministry of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Systematic teaching of mathematics is given in Bulgarian primary schools from the 1st class (children of seven years old) onwards. In the nursery-infant schools children of pre-school age are given certain notions of size and quantity.

In the 1st and 2nd primary classes, six hours a week are devoted to arithmetic, and five hours in the 3rd and 4th classes.

The first notions of geometry are taught in the 3rd and 4th classes, for one and two hours a week respectively.

SYLLABUSES

The main points of the arithmetic syllabus are as follows :—

1st class: addition and subtraction of whole numbers below 100.

2nd class: the four operations with whole numbers below 1,000.

3rd class: the four operations with whole numbers below 1,000,000.

4th class: the four operations with whole numbers above 1,000,000 ; interest ; metric system.

In all classes almost half the time devoted to arithmetic is spent in exercises.

Generally speaking no reference is made to mathematical ideas in the teaching of other subjects.

Although yearly and school leaving examinations do not exist in Bulgaria, it may nevertheless be said that the knowledge of arithmetic covered by the syllabus is compulsory.

AIMS

The introduction to mathematics in Bulgarian primary schools has a double aim : a) to give children a useful, practical knowledge of mathematics, and b) to aid their general intellectual development.

METHODS

The Ministry of Education systematically issues recommendations to teachers as to method.

Arithmetic is taught principally through lessons involving analysis, synthesis, induction and deduction.

Teaching material consists mainly of ball-frames, pictures, representational graphs, geometrical figures and the like. It is graded according to age.

Textbooks with well graded exercises are published by the Ministry of Education.

Solving a concrete problem may occasionally take the form of a game, but in principle activity methods are rejected, inasmuch as they come between a child and his textbook and thus prove detrimental to the systematic acquisition of knowledge.

MISCELLANEOUS

Fundamental reforms were made in 1945 in the arithmetic and geometry syllabuses. Two more hours a week were reserved in the time-table for these subjects, which thus gained in importance.

Syllabuses and textbooks were again improved in 1947-1948. A competition, moreover, was recently instituted for arithmetic textbooks for the 2nd and 3rd classes. Geometry textbooks for the 3rd and 4th classes are to be published shortly.

The Ministry of Education is preparing to publish original and translated works on method. Teaching method is also quite frequently the subject of articles in the educational journals published by the Ministry and the teachers' association.

The manufacture of teaching material is in the hands of a specialist firm.

CANADA

Alberta

From the reply sent by the Ministry of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

The teaching of arithmetic begins in Grade I (children of six years of age), and five periods a week (one per day) are devoted to it.

Geometry is not referred to in primary schools.

SYLLABUSES

The expected accomplishment for each grade is as follows :—

Grade I: counting up to 20 ; some knowledge of the separate numbers in the series to 10 ; oral use of the ordinals to sixth or seventh ; recognition of groups of objects to 4 and of regular patterns of objects to 6 or 7 ; reading and writing the numerals to 10 ; intelligent control over the addition and subtraction combinations of 6 ; understanding and use of the processes of addition and subtraction ; reading and writing the combinations horizontally and vertically ; possession of a small reading vocabulary of number words and symbols ; appreciation of the social value of arithmetic.

Grade II, first term: counting up to 100 by ones and by tens ; reading and writing numbers to 100 ; knowledge of the place of the numbers in the series to 100 ; use of ordinals to eighth ; understanding of the significance of 10 as the basic unit in the second decade numbers (and some appreciation of its significance in large numbers) ; intelligent control over the separate addition and subtraction combinations of 9 ; understanding of addition as the process of putting numbers together and of subtraction as the process of taking away a part (two ideas, " how many left " and " how many gone ") ; understanding of the relationships between addition and subtraction, and between the addition combinations and their corresponding subtraction combinations (direct and reverse) ; column addition to sums of 9, three addends, with and without 0 ; understanding of ½ as applied to single objects ; simple reading vocabulary for number work; appreciation of the social value of arithmetic, a disposition to use the arithmetic already learned, and an eagerness to learn more.

Grade II, second term: increased understanding of the numbers to 100, ordinals to tenth; counting by twos to 20, by fives to 100, and by threes to 30; intelligent control over the addition and subtraction combinations of 11; increased understanding of the relationship between addition and subtraction as processes and as revealed in corresponding combinations; intelligent control over the 0 combinations; enriched understanding of the processes of addition and subtraction, with extension of subtraction to cover the "difference" idea; column and horizontal addition to sums of 11, three digits; higher decade addition and subtraction, sums and minuends to 19; use of $^1/_4$ and $^1/_3$ as applied to single objects; use of numbers in money and in telling time; reading and writing Roman numerals up to 12; increased reading vocabulary for number work; growing appreciation of the social value of arithmetic, together with increasing disposition to use arithmetic already learned and eagerness to learn more.

Grade III: remaining basic addition facts to 18, use of the plus sign, one-column, two-column and three-column addition with and without carrying in one or more columns, checking addition; remaining basic subtraction facts, minuends exceeding 10, use of minus sign, subtracting two- and three-digit numbers with single or double borrowing, checking subtraction, borrowing involving zero; multiplication concept and multiplication sign, basic multiplication facts with 1, 2 and 3, multiplication of two- and three-digit numbers, carrying once, multiplication with zero, checking multiplication; division concept and division sign; basic division facts with 2 and 3, one-digit quotient with remainder, two-digit quotient without remainder, dividing zero; reading number words to one hundred; place value for hundreds, tens and units; reading and writing number to 999, meaning of zero; meaning of $^1/_2$, $^1/_3$, $^1/_4$ applied to a unit or a collection; writing one-half, and one-third in figures, finding $^1/_2$ and $^1/_3$ of a number; reading, writing, adding and sutracting dollars and cents; counting money and giving change; solving problems containing extra numbers, or involving the four rules or without numbers; use of calendar and telling time to five-minute intervals; inch, foot and yard; ounces and pounds; pints, quarts, gallons; identification of circle, triangle and square; understanding and applying measurement information and computational processes; understanding a problem situation; visualizing spatial relationships; detecting fallacies and absurdities.

Grade IV: continued practice in addition; subtraction involving zero in minuend; basic multiplication facts with 4, 5, 6, 7, 8, 9 and 10; multiplication involving carrying twice, multiplication with 2-digit multiplier ; basic division facts with 4, 5, 6, 7, 8 and 9 ; division with one-digit divisor, three-digit quotient and remainder ; zero in quotient, checking division ; reading and writing numbers to 99,999, zero and place value ; Roman numerals to 30 ; multiplication and division with money ; problems involving two steps and two answers ; telling and writing time to one-minute intervals ; pints, quarts, gallons ; quarts, pecks, bushels ; reading thermometer ; inch, foot, yard, mile ; ounces, pound, ton ; meaning of fractions, equal fractions, the ruler and fractions.

Grade V: continued practice in addition and subtraction ; multiplication with three-digit multipliers ; division with two-digit divisors, final zero in quotient, rule of 9, remainders in fractional form ; 6-, 7-, 8- and 9-digit numbers ; Roman numerals up to 100 ; accounts and savings ; prices based on units of more than one ; equal shares and averages ; problems using tabular data, three-step problems ; perimeter concept ; time zones ; seconds, minutes, hours, 24-hour system ; adding and subtracting fractions with common denominators ; adding and subtracting proper fractions, and mixed and whole numbers (without borrowing).

Grade VI: continued practice in addition, subtraction and multiplication ; division with three-digit divisor ; the four rules with fractions ; decimal fraction concept including tenths, hundredths, thousandths and ten-thousandths ; multiplication and division of decimal by whole number, decimal by decimal and whole number by decimal ; changing remainders to decimal ; square measure ; yards and metres ; the four rules with compound measures ; rods and acres ; lines and angles ; dimensions, perimeters and areas of rectangles ; reading and using scale drawings, reading and interpreting bar graphs and line graphs ; cash accounts, saving accounts ; solving problems using fractions and decimals, using diagrams.

At all levels, considerable importance is given to practical work. Incidental connections are established between mathematics and social studies (graphs).

The importance attached to mathematics in the yearly and leaving examinations is at the discretion of the teacher.

METHODS

The attention of all teachers is directed to two principles that should underlie all arithmetic teaching :—

a) meaning must be established before memorisation be required ;

b) quantitative understanding involves reading skills and study skills, and every elementary teacher must accordingly maintain a reading programme in arithmetic to match the progress of his class.

Lessons are chiefly formal, but teaching aids, such as counting sticks and rulers, are used.

The official instructions require the use of textbooks chosen by selected teachers' committees. There are also recommended books for the teacher's use.

British Columbia

From the reply sent by the Department of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Mathematics are introduced from Grade I or kindergarten where in operation (children of five or six years of age). The subject is called number work in Grades I, II and III, and arithmetic in Grades IV, V and VI. The time devoted to it is 100 minutes per week in Grades I and II, 150 minutes in Grade III, and 200 minutes in Grade IV, V and VI.

Geometry is not referred to in the primary school.

SYLLABUSES

The general aims and major skills for each grade are as follows :—

Grade I : Aims : to draw upon a child's past experiences so as to make number interesting and meaningful ; to enrich the learning environment by providing practical activities in which he will have many opportunities to sense the need and value of number ; to emphasize the arithmetical phases of the everyday activities in which he may apply his acquired knowledge of number and so make new discoveries for himself ; to develop an understanding and appreciation of the social applications and uses of number in the activities of daily life ; to develop his interest in number through various types of projects and creative activities. Major skill : counting, grouping, reading and writing numbers, number vocabulary.

Grade II : Aims : to broaden a child's number background so that he may understand and appreciate the importance of arithmetic in everyday life ; to develop his ability to understand and use the fundamental processes of addition and subtraction taught in the grade ; to develop his skill in solving problems ; to form habits of accuracy, neatness and orderly arrangement in all work ; to provide practical activities, in which a pupil gradually increases, through purposeful use, his comprehension of the meaning and use of a number vocabulary ; to establish the habit of checking. Major skills : addition and subtraction facts to 18 ; extension without bridging ; column addition without bridging.

Grade III : Aims : a child at this stage is helped toward efficient computational ability by making automatic the number facts in addition and subtraction, by learning the multiplication and possibly the division facts of the twos, threes, fours and fives, by forming habits of accuracy, neatness, and orderly arrangement in all work, and by establishing the habit of checking results. Major skills : addition and subtraction with carrying or borrowing ; multiplication involving 2-, 3-, 4- and 5-times facts and their reverses ; division involving the facts with 2, 3, 4 and 5 and their reverses.

Grade IV : Aims : children here grow in ability to compute well by making automatic the primary addition and subtraction facts, and the multiplication and division facts, of the twos, threes, fours and fives ; learning the multiplication and division facts of the sixes, sevens, eights and nines ; learning the processes involved in multiplication and division ; learning to use integers in the four fundamental processes with ease and accuracy ; continuing to develop habits of neatness, accuracy, and orderly arrangement in all work ; continuing to establish the habit of checking results. Major skills : basic multiplication and division facts stressed ; multiplication by two- and three-digit numbers ; division by one-digit numbers (long division form) ; division by two-digit numbers.

Grade V : Aims : children here grow in ability to compute efficiently by increasing their skill in the fundamental operations with integers, finishing the development of the process of long division, developing ability to use fractions in addition and subtraction, maintaining and developing further the habits of neatness, accuracy, and orderly arrangement in all written work, developing ability to meet all ordinary demands in the use of measurement as applied to linear and square measure, and maintaining the habit of checking results. Major skills : long division completed ; addition and subtraction of common fractions completed.

Grade VI : Purposes : children at this level grow in ability to compute efficiently by forming a concept of the fractional nature of the decimal, its value and use, acquiring an arithmetical vocabulary, and facts and processes dealing with integers, fractions and decimals, understanding the use of the graph in picturing number relations, growing in accuracy and speed in the fundamental processes, gaining automatic control of number facts, and progressing in neatness and form in written work. Major skills : multiplication and division of common fractions completed ; decimal fractions completed.

In all grades, considerable importance is given to practical work. In modern primary classrooms, many situations will appear daily in which a child must make use of numbers to carry on his work and play. The teacher should grasp these opportunities so that number facts may be learned in a truly meaningful way.

Building a model home (size, shape and number of rooms), use of clock, street, number of house, telephone number, and cooking-measures, or singing of number-jingles or colouring of a certain number of objects are some of the items used to introduce mathematics in connection with social studies or music or art.

Standardised tests in arithmetic are used for diagnostic, remedial and promotional purposes.

AIMS

The course of study is based upon the belief that knowledge of the social uses of arithmetic and ability to compute efficiently are essentials of good arithmetic learning.

METHODS

The " Programme of Studies for the Elementary Schools of British Columbia ", published by the Department of Education, suggests a series of activities and problems to be done in each grade. The course of study is based upon the " meaning " theory rather than upon the " drill " theory or the " incidental learning " theory, although both drill and incidental learning have their place.

Blocks, games, sand-tables, charts, etc. are used for learning arithmetic.

The programme mentioned prescribes the use of textbooks and teacher's guides, the selection of which is usually the responsibility of a curriculum committee who consult sub-committees of specialists. For the Grade I first term, no work book of any kind may be used ; all number work must be informal and oral and arise from activities.

MISCELLANEOUS

Among the most recent works published on the teaching of mathematics in primary schools are to be noticed :—

Harry AMOSS's " Rhythmic Arithmetic " (Toronto, 1945) ; E. R. ANDERSON and W. R. SHANKLIN's " Everyday Mathematics " (Toronto 1943) ; and W. Y. MCLEISH's " Vocational Mathematics " (Victoria, 1938).

Manitoba

From the reply sent by the Department of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Arithmetic begins in the first Grade (children of six years of age), and approximately five periods a week are devoted to it. Geometrical concepts are introduced from the beginning.

SYLLABUSES

In brief the matters dealt with are as follows :—

Grade I: easy group 36 primary addition facts ; primary subtraction facts based upon addition, no formal drill ; comparison as to size (large, smaller, more, longer, etc.) ; use of measurement units (foot, yard ; 1c, 5c, 10c, 25c ; hour, day, week, month ; pint, quart) ; recognition of square, circle, half-circle, triangle, star, line, point ; the meaning of half as applied to a single object ; geometric forms, groups of objects, but not applied to pure number ; oral one-step problems using the addition and subtraction facts studied ; developing vocabulary needed.

Grade II: 100 primary addition facts and 100 primary subtraction facts with drill ; limited number of multiplication facts developed from addition, no formal drill ; a few division facts as the inverse of multiplication facts studied, but no formal drill on these ; extending vocabulary in measurement and comparison ; use of measurement units (inch, foot, yard ; all coins ; hour, $^1/_2$ hour, $^1/_4$ hour ; use of calendar ; relation of pint and quart, ounces and pounds ; recognition of square, circle, half-circle, triangle, star, line, point, rectangle, drawing, cutting and arranging these forms in patterns ; meaning of unit fractions, $^1/_2$, $^1/_4$; proceeding from objects to the less concrete units such as geometric forms, groups of objects, the measures, pure numbers ; relating the fraction to preparatory work in multiplication and division (no formal work or written seat-work on fractions) ; oral and written one-step problems in addition and subtraction, using only the facts studied, avoiding formal statements ; developing vocabulary needed.

Grade III: reviewing primary addition and subtraction facts ; secondary addition facts ; introducing secondary subtraction facts in preparation for short division ; column addition and subtraction ; completing the multiplication facts except 1-times and 0-times ; division facts, developed from the multiplication facts studied ; mile, gallon, bushel, minute and second, and ton ; expressing measures in combination, easy oral reductions in some of these measures ; estimates and checking by actual measurements ; construction of rectangles and squares according to instructions; $^1/_2$'s, $^1/_3$'s, $^1/_4$'s, developing meaning of fractional notation; introducing equivalent fractions by concrete illustration; use of multiplication and division facts to develop an understanding of $^1/_2$ of 8, $^3/_4$ of 20, etc. (drill may now be given); oral and written one-step problems using number facts and operations studied; an occasional easy two-step problem may be given; developing vocabulary needed.

Grade IV: checking the 100 multiplication facts for complete mastery; the 90 division facts completed; secondary addition facts required for multiplication reviewed, secondary subtraction facts required for short division reviewed; multiplication of three- or four-digit number by a three-digit multiplier; short division, three-figure dividend; maintaining skill in primary and secondary addition and subtraction facts; measuring and estimating, reductions, rod introduced; continuing construction of rectangles and squares to specifications; drawing circles with a given radius or diameter; finding perimeters of squares and rectangles; equivalent fractions, principle of equivalence; adding, subtracting, multiplying and dividing with decimal of a simple kind, using the dollars and cents notation; one- and two- step problems, and an occasional easy three-step problem; problems without numbers, generalizing procedures; unitary analysis.

Grade V: compound addition, subtraction and multiplication with two units; long division, three-digit dividend, two-digit divisor; reductions of measures; units of square measure, acre introduced; area concept; measuring areas of rectangles and squares; surface areas of cubes and rectangular solids; bar graphs, plans to scale, maps; western land survey; measuring circumferences of cylindrical objects with a string; addition and subtraction of proper fractions and mixed numbers; L.C.D. by trial; multiplication with fractions, division introduced.

Grade VI: developing speed and accuracy in the four rules; further common measures; the four compound operations with two units only; reductions; units of cubic measure; volume concept; measuring volumes of rectangular solids and cubes; constructing rectangular solids and cubes out of paper from patterns; line graphs, maps and plans; division with fractions completed, division with mixed numbers; reading, writing and interpreting decimals, decimal calculation (relate to work done with dollars and cents); one-, two-, and three- step problems, with occasionally one of several steps; running problems; diagnosis and remedial work for problem failures.

Practical work consists mainly of measuring and estimating, making scale drawings and keeping records.

Mathematics may be introduced incidentally in connection with other subjects (keeping records of rainy days, clear days, seeds in pods, parts of a flower, etc.).

In the yearly and leaving examinations, the same importance is attached to mathematics as to other subjects.

AIMS

The main objectives in teaching arithmetic to children in the elementary school will be to help them develop :

a) understanding of, and growing ability to use, the different kinds of number : integers, common fractions, decimals and measures ;

b) growing understanding of the meaning, procedure and uses of counting, the tens system, and addition, subtraction, multiplication and division applied to the different kinds of number listed in a) ;

c) increasing power in problem solving ; this implies a growing ability to use arithmetical ideas, principles and skills in the problems of life as they are met at home, in school, on the farm, in the store, on the playground, etc. ; knowledge of business practice must be acquired by older pupils ;

d) gradually improving accuracy and speed in the four processes of addition, subtraction, multiplication and division, applied to the different kinds of number ;

e) a growing appreciation of the usefulness and power of arithmetic and an increasing tendency to use arithmetic and to recognize and seize opportunities to use it.

METHODS

The curriculum booklet on arithmetic is issued to each teacher. It suggests activities and how to use them. It recommends the teacher to help a child to learn arithmetic by a) giving him a purpose, b) making sure that he is ready, c) arranging for him to work with other children, d) teaching him in terms of what he knows and understands, e) helping him to see and apply number relationships and principles and f) helping him to use his arithmetic in his daily life.

Small cardboard squares each with a symbol on one side, a supply of shoe pegs, small sticks, buttons, bottle caps, and large flash cards on each of which appears the number symbol with the corresponding pictured group of objects or group of dots on the reverse side, are used in Grade I as teaching aids. At the same level, games and rhymes are also used.

There are books prescribed by the Department of Education as " authorized texts " and " recommended work books ".

New Brunswick

From the reply sent by the Department of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Arithmetic is taught from Grade I (children of six years of age) onwards. About five periods a week are devoted to it.

Geometry is not referred to in the primary school.

SYLLABUSES

The work to be done in each grade is as follows:—

Grade I: counting to 20 with objects; counting by ones to 10 and by tens to 100 by rote; recognition of groups of objects without counting them; recognition of numbers to 100; reading and printing numbers in figures and words to 10, in figures to 20; knowledge of ordinals to fifth, using and understanding one-half (orally); repeated experience with the addition and subtraction facts to 10, using objects; counting of objects by ones, twos, to ten; recognizing 1c, 5c, 10c pieces; practical knowledge of 1c, 2c and 3c stamps; solving and making simple problems in relation to a child's own experiences and activities, involving counting, comparison and the use of addition and subtraction facts used orally and with objects (without being required to memorize these facts), results not to exceed 10; experience to establish the meaning of the following and other like terms: big, bigger, biggest; little, less, least; many, more, most; high, higher, highest; tall, taller, tallest; large, larger, largest; small, smaller, smallest; few, fewer, fewest; more than, less than; under, over; first, next, last; yesterday, today, tomorrow.

Grade II: counting continued as in Grade I and extended to 100; counting by 100's to 1,000 by rote; recognizing numbers to 1,000; reading and writing numbers in figures and words to 20, in figures to 100; the position of tens and units; knowledge of ordinals to tenth; using and understanding one-half, one-quarter (orally); learning the addition and subtraction facts to 18; single column addition, limited to five addends; two column addition, limited to three addends and without carrying; subtraction of two-digit numbers without borrowing; counting objects by ones, twos, threes, fours, fives, to 20; practice in measuring with the inch, foot, pint, quart and dozen; telling time with Arabic figures to the nearest 5-minute period; extending the knowledge of Canadian coins to the 25c piece and 50c piece; practice in solving and making one-step problems, within the addition and subtraction requirements of the grade ; beginning definite training in the technique of the problem solving ; meaning of the terms add, subtract, sum, difference, plus and minus, with their signs (no formal definitions).

Grade III : reading and writing in figures up to 10,000, writing in words to 100 ; developing knowledge of the location of units, tens, hundreds and thousands ; knowledge of ordinals to hundredth , knowledge of Roman numerals to 12 ; meaning of fractions $^1/_2$, $^1/_3$, $^1/_4$, $^1/_5$ and $^1/_{10}$; further drill on addition facts ; single-column addition, limited to six addends ; two-column addition, limited to four addends, with carrying ; three-column addition, limited to three addends, with carrying ; further drill on subtraction facts ; subtracting two-digit and three-digit numbers with borrowing ; counting of groups extended to 50 ; learning the 2-, 3-, 4- and 5-times tables ; multiplication of two-digit and three-digit numbers by 2, 3, 4 and 5 ; division facts of 2, 3, 4 and 5 learned by reversing multiplication tables ; practical experience with, and learning the relation between, inch, foot and yard, pint and quart, pound, hundredweight and ton, minute, hour, day and week ; easy oral reductions of yards to feet, gallons to quarts, quarts to pints ; learning to call numbers on the telephone ; telling time with both Arabic and Roman numerals ; using the calendar for months and dates ; knowledge of Canadian money extended to the dollar ; solving and making one-step problems, both oral and written ; meaning of the terms half-dozen, month, multiply, times, the × sign.

Grade IV : reading and writing in figures up to 100,000, writing in words to 1,000 ; knowledge of Roman numerals to 100 ; continued experience with fractions in problem form, to develop the idea of the unit fraction in relation to feet, inches, pounds, etc. ; equivalent fractions with objects and groups of objects ; single-column addition, limited to eight addends ; two-column addition, limited to six addends ; three-column addition, limited to four addends ; subtraction of four-digit numbers with various difficulties of noughts and borrowing ; addition and subtraction of Canadian money, not exceeding $10 ; learning the 6-, 7-, 8-, 9- and 10-times tables ; multiplying two-digit and three-digit numbers by each number from 2 to 9 ; multiplying by two-digit multipliers ; learning the division facts of 6, 7, 8, 9 and 10 ; division by the numbers to ten, with dividends of two and three digits ; averages ; multiplying and dividing Canadian money by one-digit numbers ; continued experience with simple measures including seconds, minutes, days, weeks and years ; number of days in the months ; easy reduction of measures involving only two consecutive units ; practice in reading the thermometer ; solving two-step problems ; meaning of the terms divide, division, the division sign, divisor, multiplier, a.m., p.m., temperature, degree, freezing point and zero ; abbreviations of units of measures used.

Grade V: reading and writing numbers up to 1,000,000; knowledge of Roman numerals completed; meaning and use of fractions in common use, to sixteenths; meaning and use of decimals of not more than two places; memorizing of common fractions and decimal equivalents ($^1/_2$ is 0.5, $^1/_4$ is 0.25, etc.); three- and four-column addition, limited to six addends; addition and subtraction of fractions and mixed numbers (denominators not to exceed 16), and of decimals of not more than two places; subtracting five-digit and six-digit numbers, stressing various difficulties of noughts and borrowing; addition and subtraction of Canadian money (amounts not to exceed \$100); learning the 11- and 12-times tables; multiplying three-digit numbers by three-digit multipliers; multiplication of Canadian money by two-digit and three-digit multipliers; finding fractions of simple quantities; changing easy mixed numbers to improper fractions, and vice-versa; division with one-digit divisors, with dividend up to four digits; division with two-digit divisors, with the unit figure not greater than 5 and dividend not more than five digits; finding what fraction one number is of another; common measures, including pecks and bushels continued; easy reduction involving only two consecutive units; practical experience to establish the concept of the mile and rod; reading speedometers; simple graphs; solving of two-step problems of a practical nature involving both whole numbers and fractions within the experience of the child; meaning of the terms decimal, unit fraction, proper fraction, improper fraction, mixed number, denominator, numerator, decimal point, etc.

Grade VI: reading and writing of numbers within reasonable limits; meaning and use of decimals to four places; addition and subtraction of fractions and mixed numbers, denominators not to exceed 64; addition and subtraction of decimals of not more than four places; multiplication and division of decimals; multiplication and division of easy fractions and mixed numbers, such as halves, thirds, quarters, etc.; division with two-digit and three-digit divisors; measures and estimating with common units of measures such as feet, yards, ounces, pounds, pints, quarts. etc.; the square inch, square foot and square yard explained; measurements of surfaces made and checked by measuring; idea of the acre and square mile developed, but no reduction involving them to be required; finding areas of squares and rectangles; practical knowledge of the English coins in common use; building up tables of common weights and measures and then memorising; practice problems in easy reduction of a practical nature; solving of two-step and three-step problems of a practical nature and within a child's experience, involving whole numbers, fractions and decimals as laid down for the grade; practice in understanding and making simple bills and receipts; meaning of the terms area, perimeter, etc.; abbreviations of the new units of measure used.

In all grades, arithmetic may be motivated through class and group activities which give a large place to practical work in connection with other subjects.

In the yearly and leaving examinations, almost as much importance as is given to language is attached to mathematics.

AIMS

It is the aim of arithmetic to give a child a) an appreciation of the social value of arithmetic ; b) a clear idea of certain relations of number, time and space ; c) skill in performing the fundamental operations on numbers ; and d) ability to apply this skill intelligently and accurately in the solution of everyday problems involving number relations.

METHODS

Official suggestions concerning the teaching of arithmetic are laid down in the " Programme of Studies for New Brunswick Schools, Grades I to VI ". Their leading principles are as follows :—

" New ideas and processes should be introduced from problems arising in the child's own activities, problems natural to the child, which he feels to be real and of interest to him. But at all stages, before teaching new ideas the teacher should assure herself that the child is proficient in the work already covered, and thus prepared to advance to new work. After teaching a new process, exercises must be worked by the pupils to fix the new idea. Sufficient of this practice work must be done by each pupil to ensure his mastery of the process. For those who secure this mastery before the others, additional varied and more difficult exercises may be assigned, or they may be permitted to work on some class or group activity, or to read for enjoyment.

" Mathematically inclined children will be found who delight in solving difficult problems. Supplementary arithmetic texts containing suitable problems should be available in the school to supply their needs. Through the use of such material profitable extra work may be done by these children, while those of less mathematical ability are obtaining mastery of the minimum required skills. Except as an aid to retention, there is no object in continued drilling of pupils on processes they already understand and can handle.

" A diagnostic test, followed by remedial teaching, if necessary, should be given after the class has apparently mastered new work. *Remedial teaching, to be of real value must be individualized, so that each child is drilled on the particular points which he found difficult.* In order to do this, teachers will find it necessary to make use of printed and written material for the child's individual use. In order to promote the child's interest in this work, improvement should be emphasized rather than actual standing. The keeping of individual graphs of progress and other such records is a valuable aid in this. "

Number games and activities involving arithmetic, such as the arranging of a toy shop, shopping and bank projects, and a play post office, are used to stimulate an active interest in arithmetic.

The official instructions require the use of textbooks from Grade III onwards. These are chosen from a considerable quantity of material available for the various grades. Choice is made by the provincial curriculum committee.

MISCELLANEOUS

The most recent works published on the teaching of mathematics in elementary schools are J. W. STUDEBAKER, F. B. KNIGHT, and W. C. FINDLEY'S " Teacher's Handbook for Primary Arithmetic ", and STUDEBAKER, Findley, KNIGHT and RUCH'S " Teacher's Guidebook " for various grades.

Newfoundland

From the reply sent by the Department of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Number work is done in Grades I and II (children of six years of age) for five periods per week. From Grade III onwards, arithmetic is taught, five periods a week being devoted to it.

Geometry is not a separate subject at primary level.

SYLLABUSES

The main objectives for each grade are as follows :—

Grade I: to know numbers to 100 ; to write numbers ; to count by ones to 100, by twos to 20, by fives to 100, by tens to 100 ; to learn the addition concept, and to know the facts to 10 ; to learn the subtraction concept, and to know the facts to 10 ; to add columns based on the addition facts to 10; to know the ordinals to fifth; to tell time to the hour ; to know the cent; to know the meaning of $^1/_2$; to build up a number vocabulary.

Grade II: to know the remaining 55 addition facts to 18 ; to know the corresponding subtraction facts ; to know the 765 higher decade facts with sums to 99 ; to know column addition to 5 addends ; to know the numbers 101-1,000 ; to know the addition of two- and three-digit numbers of four addends, first without carrying, then with carrying ; to subtract two- and three-digit numbers, without borrowing and with borrowing ; to know the meaning of $^1/_2$ and $^1/_4$; to know the Roman numerals up to 12 ; to tell time correct to 5 minutes ; learning the meaning of words that tell size, position, form, quantity, weight and time.

Grade III: to know the numbers 1,001-10,000 ; to read and write dollars and cents ; to add five three-digit numbers, and two four-digit numbers ; to subtract three- and four-digit numbers, borrowing more than once ; to learn the multiplication concept ; to know the ninety multiplication facts, and to multiply two- and three-digit numbers by a one-digit number without and with carrying ; to learn the division concept ; to know the ninety division facts without remainders ; to know the Roman numerals to 39 ; to know the calendar ; to tell time to the minute ; to do one-step problems ; to learn the meaning of words that tell size, position, form, quantity, weight and time.

Grade IV: to know numbers to 100,000 ; to add four-digit numbers to six addends and five-digit numbers ; to subtract five-digit numbers ; to multiply by a two-digit number ; to know the division facts with remainders ; to divide by one- and two-digit numbers ; to know the 175 higher decade subtraction facts required in short division ; to do short division with divisors from 2 to 9 ; to know the ton, mile, bushel and peck ; to know the Roman numerals up to 100 ; to do two-step problems ; to recognize square, rectangle, triangle and circle ; to know the meaning of averages ; to know the meaning of non-unit fractions.

Practical work in counting, using money, solving problems, telling the time, etc., is encouraged.

Except in games, no attempt is made to introduce children to mathematics incidentally.

AIMS

Official instructions concerning aims of teaching primary arithmetic are a) to develop understandings and skills, and b) to develop appreciation of the important part that numbers play in life.

METHODS

There are official suggestions concerning the teaching of these subjects in the form of handbooks for teachers.

The suggested procedure is to : 1) teach the material of the unit ; 2) give a diagnostic test (a test designed to discover weaknesses) ; 3) diagnose the errors to arrive at their cause ; 4) do remedial teaching ; and then 5) test again.

The following suggestions are also made :—

" His (the child's) own needs and interests are not enough to determine the instructional material : the needs of the future must be considered. To follow only the interests of the child would undoubtedly ignore the desirability of well organized drill. Conventional as they are, these matters cannot be neglected in favour of any theory of instruction that is not supported by a reliable body of objective data. "

The chief aids to teaching arithmetic are concrete materials such as number blocks, coins and workbooks.

Official instructions require the use of textbooks from Grade III onwards, and workbooks in Grades I and II. These books have been prepared by the Department of Education, and are adapted to age and environment.

MISCELLANEOUS

Modifications have been and are still being made in the teaching of arithmetic in order to bring the teaching into line with modern methods.

Nova Scotia

From the reply sent by the Department of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Arithmetic is introduced from Grade I onwards. The amount of school time devoted to the subject is 15% in Grades I, II, III and IV, and 20% in Grades V and VI (1% of the time is approximately 12 minutes per week in Grades I, II and III, and 15 minutes in Grades IV, V and VI).

SYLLABUSES

The objectives to be attained in each grade are as follows :—

Grade I: to know numbers up to 100 ; to count by twos to 20 and by fives to 100 ; to write numbers ; to learn the addition concept ; to learn the subtraction concept ; to know the addition and subtraction facts to 10 ; to add columns based on the addition facts to 10 ; to know the ordinals up to ninth ; to know the value of the coins (cent, five-cent piece, ten-cent piece) ; to know the foot ; to know the dozen ; to know the quart and pint ; to know day, month, day of the month, yesterday, tomorrow ; to know the meaning of taller, shorter, longer, larger, smaller, higher, lower, heavier, lighter, nearer, farther, more, less, few, fewer, fewest, many, most.

Grade II: to know numbers up to 1,000 ; to read and write numbers up to 1,000 ; to know the 100 addition facts ; to know the 100 subtraction facts ; to know the 225 higher decade addition facts with sums to 39 ; to know single column addition to six addends ; to add two-digit numbers with four addends ; to add and subtract two- and three-place numbers without carrying or borrowing ; to know the multiplication and division facts associated with $1+1$, $2+2$, to $9+9$; to know the meaning of inch, pound, half-pound, quarter-pound, the coins, dollar, hour, half-hour, quarter-hour, minute, half-dozen ; to tell time using hours, half-hours and quarter-hours ; to know the meaning of one-half and one-fourth ; to know the Roman numerals to 12 ; to know the subtraction concepts take away, how much more, and comparison ; to do simple one-step problems orally.

Grade III : to know numbers to 10,000 (no problem with numbers greater than 10,000 to be given in this grade); to read and write numbers to 10,000 ; to read and write dollars and cents ; to add numbers, carrying more than once ; to subtract numbers, borrowing more than once ; to learn the multiplication concept ; to learn the division concept ; to know the ninety multiplication facts ; to know the ninety division facts without remainders ; to multiply two- and three-place numbers by one-digit numbers without and with carrying ; to divide two- and three-digit numbers by one-digit numbers without and with carrying; to know the Roman numerals to 30; to know the ounce, gallon, yard, feet in a yard, inches in a yard, and the calendar ; to tell time ; to do one-step problems orally ; to be able to take $^1/_2$, $^1/_3$, $^1/_4$, $^1/_5$, $^1/_6$, $^1/_8$, $^1/_9$, of one- and two-digit numbers when there are no remainders.

Grade IV : to know numbers beyond 10,000 ; to read and write numbers beyond 10,000 ; to know the higher decade addition facts up to 99 ; to add four-digit numbers to six addends ; to subtract numbers with five-digit minuends ; to multiply by a two-digit number ; to multiply by a number ending in one, two or three zeros ; to divide three-, four- and five-digit numbers by two-digit numbers ; to know the 175 higher decade subtraction facts required in short division ; to know short division with the divisors 2-9 ; to be able to take $^3/_4$ and $^2/_3$ of numbers where the division is even; to know the fractions $^1/_2$, $^1/_4$, $^1/_8$, $^3/_8$, $^5/_8$ and $^7/_8$; to add and subtract mixed numbers of the fractions mentioned above ; to know the ton, pounds in a ton, the mile, feet in a mile, the bushel and peck ; to know 50, 100 and 1,000 in Roman numerals ; to do one-step and simple two-step problems, chiefly orally ; to recognize the square, rectangle and triangle.

Grade V : to know and read large numbers to millions ; to add and subtract numbers to six places ; to multiply by a three-digit number ; to multiply by a three-digit number, with zero in the middle ; to divide five- and six-digit numbers by three-digit numbers ; to know the meaning of the common fractions used in everyday life, particularly halves, thirds, fourths, fifths, sixths, eighths, tenths, twelfths and sixteenths ; to add the common fractions just mentioned ; to subtract these fractions without borrowing ; to multiply and to divide common fractions ; to read and write decimals to hundredths ; to add decimals hundredths ; to subtract decimals to hundredths ; to multiply a decimal to hundredths by a whole number ; to divide a decimal to hundredths by a whole number without remainder ; to know the rod and its relation to feet and yards ; the square inch, square foot and square yard, the number of inches in a square foot and the number of square feet in a square yard ; to find the area of a rectangle using square inches, square feet and square yards ; to know how to keep an account as in budgeting ; to do one- and two-step problems, both orally and in writing.

Grade VI : to read large numbers to millions ; to add numbers of five and six digits with six and seven addends in the addition ; to subtract numbers of five and six digits ; to multiply four-digit numbers by two- and three-digit numbers ; to divide numbers of five and six digits by numbers of two and three digits, to review and consolidate the knowledge of common fractions studied in Grade V, particularly those used in everyday life ; to read and write decimals to ten-thousandths; to add decimals to ten-thousandths; to subtract decimals to ten-thousandths ; to multiply decimals to ten-thousandths ; to divide decimals to ten-thousandths ; to know the meaning of per cent ; to know how to change decimal fractions to percentages ; to know the equivalents in per cent of simple fractions ; to know how to obtain the percentage of a number ; to know how to obtain what percentage one number is of another ; to be able to understand and calculate sale discounts ; to know how to make out bills and receipts ; to understand a bank account ; to know simple interest and its calculation for years and parts of a year ; to add, subtract, multiply and divide denominative numbers containing two units ; to know the tables of length, liquid and dry measure, weight, time and square measure to the acre ; to know how to find the area of a rectangle and to calculate its perimeter ; to solve one- and two-step problems.

The course of study has been established according to the principle that, as far as possible, new material should be introduced through the medium of real and interesting situations.

AIMS

The teaching of arithmetic in elementary schools is expected to give a child speed and accuracy in simple arithmetical operations and to contribute to his training for effective participation in adult group activities and productive labour.

METHODS

The handbook published by the Department of Education comments on, and gives the content by units of, the course of study in arithmetic. Any unit or cycle of instruction follows a definite procedure. The steps in the development are : 1) introduction of the material ; 2) mastery of it ; 3) test to determine how much of it has been learned ; 4) diagnosis to single out weaknesses ; 5) remedial teaching to correct them ; 6) test to find how far the remedial work has been successful.

Concrete objects, coins and measures are used as teaching aids.

Ontario

From the reply sent by the Department of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Children gain experiences in arithmetic from their earliest stage in junior kindergartens (three years of age).

In the elementary schools, there are no rigid time limits in the programme. According to the balance recommended, approximately 10% of the time (half-an-hour per day) must be devoted to arithmetic.

SYLLABUSES

In outline, the matters dealt with are :—

Grade I: counting objects to 20 ; rote counting to 100 ; counting by twos to 20 ; counting by tens to 100 ; writing numbers in figures to 10 ; recognition of numbers to 100 ; meaning of ordinals, first to fifth ; meaning of one-half (no numerical form) ; addition and subtraction facts to 10 ; grouping objects (10 or fewer) in twos ; meaning and use of terms big, bigger, biggest, short, long, under, over, around, first, last, next, line, point, square, round, straight, many, more, most, some, few, morning, afternoon, night, yesterday ; knowledge of the coins cent, five cents, ten cents ; knowledge of the one-, two- and three-cent stamps ; oral problems in story form, related to experiences of children in the classroom, arising from activities and enterprises, involving counting, comparison of size and quantities, and addition and subtraction within the limits of 10, solved objectively.

Grade II: counting continued and extended beyond 100; counting by 100's to 1,000; counting by 2's, 10's, 5's, 4's; counting backward by 1's, 10's, 2's, 5's; reading the numbers to 1,000; writing of numbers in figures to 100 ; meaning of ordinals to tenth ; meaning of one-half, one-quarter (no numerical form) ; mastery of addition and subtraction facts to 10; extensions in higher decades of facts to 10; single-column addition limited to five digits ; addition of two-digit numbers, no carrying, limited to three addends; subtraction of two-digit numbers, no borrowing or carrying ; meaning and use of terms add, subtract, sum, answer (no formal definitions) ; grouping objects (20 or fewer) in 2's and 3's ; meaning of terms relating to size, quantity, etc. ; measuring with the inch, the foot, the pint, the quart, relationships discovered by actual experience ; familiarity with Canadian coins, relationships learned by experiences, purchasing power of each, making change ; meaning and use of hour, day, week ; telling time to five-minute intervals ; reading Roman numerals to 12 ; oral one-step problems in addition and subtraction ; written one-step problems (formal solutions not required) ; training in problem-solving.

Grade III: reading and writing in figures to 10,000, place-value of units, tens, hundreds, thousands; reading and writing Roman numerals to 20; meaning and expression of $^1/_2$, $^1/_4$, $^1/_3$ (concrete treatment); facts of numbers 11 to 18; extension in higher decades; single-column addition, limited to 6 addends; addition of two-digit numbers with carrying, limited to 4 addends; addition of three-digit numbers, without and with gaps, limited to 3 addends; meaning and use of terms column, zero, carry, carrying, plus, the sign + (no formal definitions); addition of Canadian money; checking addition by adding down; subtracting two- and three-digit numbers, without and with borrowing or carrying; careful treatment of zero difficulties; meaning and use of terms less, remainder, borrow, borrowing, minus, the sign —; checking subtraction by adding remainder and subtrahend; counting by 2's, 3's, 4's, 5's to 50; the 2-, 3-, 4- and 5- times tables; multiplying two- and three-digit numbers by 2, 3, 4, 5; meaning and use of terms multiplication, multiply, times; sign × read as times or multiplied by; checking multiplication by reworking; measuring and estimating in inches and half-inches, in feet and inches; meaning of yard; relations of yards, feet and inches; measuring in yards and feet; meaning of terms height, depth, thickness, breadth; measuring and estimating in half-pints, in pints, in quarts; meaning of gallon, relationship of pint, quart, gallon, easy oral reductions; relationship of minute-hour, hour-day, day-week, week-month (no reductions); reading and writing of amounts of money in dollars and cents; meaning of terms pair, dozen, half-dozen, score, square, triangle, half-circle; one-step, oral and written problems, training in problem-solving.

Grade IV: reading and writing in numbers to 5 digits; place-value extended to ten-thousands; reading and writing Roman numerals to 30; meaning and expression of $^1/_2$, $^1/_3$, $^1/_4$, $^1/_5$, $^1/_6$, $^1/_8$, in relation to an object, a small group, denominate numbers; single-column addition, total not to exceed 100; addition of two-digit numbers, limited to 5 addends; addition of three-digit numbers, limited to 4 addends; adding Canadian money to \$10.00; subtracting four-digit numbers; subtracting Canadian money, amounts less than \$10.00; 6-times to 10-times tables; multiplying two- and three-digit numbers by two-digit multipliers, without and with zero difficulties; meaning of multiplier; multiplying Canadian money by one-digit multipliers, product not in excess of \$100; division facts; division of two- and three-digit numbers, one-digit divisor; meaning of terms division, divide, divided by, divisor, dividend, quotient, remainder, sign ÷ read as divided by; dividing dollars and cents by one-digit divisor, dividend not to exceed \$10; checking division by multiplication; measuring and estimating inches, feet, yards, pints, quarts, gallons, their relationships, abbreviations; meaning of pound, ounce, estimating weights, checking by weighing; reduction of pounds to ounces;

relationships of seconds, minutes, hours, days, weeks, years ; number of days in each month ; telling time to nearest minute ; meaning and use of terms leap year, a.m., p.m., noon, midnight ; meaning of temperature, degree, freezing point, boiling point, zero ; making change from amounts up to $5.00 ; oral problems requiring one operation, or two operations when one step is a simple reduction ; written one- and two-step problems ; training in problem-solving.

Grade V : reading and writing in figures to six digits, place-value extended to hundred-thousands ; Roman numerals to 100 ; meaning and use of $^2/_3$, $^3/_4$, $^2/_5$, $^3/_5$, $^4/_5$, $^5/_6$, $^3/_8$, $^5/_8$, $^7/_8$; equivalent fractions up to eighths ; stories of the growth of the number system ; column addition of three- and four-digit numbers, limited to 5 addends, without and with gaps ; adding Canadian money ; subtracting five- and six-digit numbers, borrowing or carrying in four consecutive columns, or in three columns not consecutive ; multiplying three-digit numbers by a three-digit multiplier, without and with zero difficulties ; dividing by a one-digit divisor using long form ; dividing by two-digit divisors, dividend not exceeding five digits ; addition and subtraction of common fractions with like denominators, or with one fraction to be changed ; finding a fraction of a number ; measuring and estimating with known units ; the mile in actual experiences ; relationship of inches, feet, yards, miles ; the rod, meaning and use, relationship to mile and yard ; the peck, the bushel, meaning and use ; relationships of pints, quarts, gallons, pecks, bushels ; the ton, the hundredweight ; relationship of ounces, pounds, hundredweight, tons ; reading the thermometer ; use of units of time ; simple stories of origin of units of measure ; oral and written one- and two-step problems ; training in problem-solving.

Grade VI : reading and writing in figures of large numbers, as required in work of other subjects ; place-value extended to millions ; interpretation of Roman numerals ; meaning and use of fractions in common use ; reading and writing of decimals to three places ; decimal equivalents of $^1/_2$, $^1/_4$, $^3/_4$, $^1/_5$, $^2/_5$, $^3/_5$, $^4/_5$; meaning of terms decimal point, decimal place ; practice in addition, subtraction and multiplication, with examples such as occur in ordinary life ; division by three-digit divisors, expression of remainder as a quotient in fractional form ; addition and subtraction with common fractions, common denominator found by inspection ; finding fractional parts of a whole number ; finding what fraction one whole number is of another ; addition and subtraction with decimal fractions to three places ; measuring and estimating with known units ; meaning of square inch, square foot, square yard, actual experience in measuring ; finding area, dimensions being in same denomination ; meaning and use of square rod, acre, square mile ; relationships between units of area ; English money ; relationship of English coins to Canadian coins ; practical one-, two- and three-step problems ; use of problems made or suggested by pupils ; keeping of children's cash accounts ; understanding bills made and receipted by grocer, etc. ; training in problem-solving ; arithmetical recreations.

In all grades, interest is maintained by relating teaching to a child's own experiences and as far as possible to his own needs ; all problems should arise out of ordinary life situations.

The school has adopted the " enterprise " as a natural way of learning and has re-directed it to educational ends; children engaged on an enterprise may not know what subject they are studying nor in what period according to the time-table. It is not intended, however, that the use of enterprises should wholly replace the more familiar method of organising children's school experiences and, in addition to the training brought about by enterprises, special training is provided in language and number.

The teacher's judgment of a child's ability to engage with profit in the activities of the next grade is the deciding factor in his promotion.

AIMS

The aim of the course in arithmetic for the elementary grades is to help a child to understand the value of number in the ordinary affairs of life, provide him with training in the use of number for his own practical purposes, and form the foundation upon which his subsequent mathematical experience will be built.

The teacher must aim, also, to enlarge a child's natural interest in number, give him a feeling of confidence in his ability to make use of it, and develop a habit of accurate work.

METHODS

Official suggestions concerning the teaching of arithmetic are made in the programme of studies for public and separate schools issued by authority of the Ministry of Education.

The grade placing of the various topics of the course has been determined by the published results of research in this field and by the experience of competent and thoughtful teachers of arithmetic. In each phase of the work a child is led through successive grades to a mastery of the required skills, each grade providing in any skill the training appropriate to his needs, interests and experiences at that particular stage of his growth.

Diagnosis of difficulties and remedial teaching is insisted upon.

There are authorized textbooks arranged in an order which has been found economical of time and which is in accord with the available evidence regarding the development of mathematical ability in children.

Prince Edward Island

From the reply sent by the Department of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Arithmetic is taught from Grade I onwards. It is considered sufficient to devote to it one hour a day.

SYLLABUSES

In brief, the matters dealt with are as follows :—

Grade I: counting objects to 10 ; counting objects to 100 by 1's, 5's and 10's, and by 2's to 20 ; writing numbers to 100 ; oral addition and subtraction of small numbers to 10 ; column addition based on the addition facts to 10 ; names and values of common coins, cent, five-cent piece, ten-cent piece, etc. ; simple units—foot, dozen, quart, pint.

Grade II: reading and writing numbers to 1,000 ; rapid addition and subtraction of small numbers, automatic response ; one-column addition with six addends and two-column addition with four addends ; addition and subtraction of two- and three-digit numbers with carrying or borrowing ; multiplication and division facts associated with $1+1$, $2+2$, to $9+9$; use of halves and quarters orally without symbols in naming parts of apples, etc. ; acquaintance with and use of inch, pound, half-pound, quarter-pound, the coins, dollar, hour, half-hour, quarter-hour, minute, half-dozen ; telling the time in five-minute intervals ; the Roman numerals to 12 ; easy oral one-step problems relating to experience of pupils.

Grade III: a thorough review of the number facts learned in the preceding grades, development of speed and accuracy ; reading and writing numbers to 10,000 ; reading and writing dollars and cents ; multiplication and division facts completed ; adding and subtracting numbers, carrying and borrowing more than once ; multiplication and division of two- and three-digit numbers ; introducing checks ; common units of time, distance, capacity and currency ; reading the clock and calendar ; taking $^1/_2$, $^1/_3$, $^1/_4$, etc. of one- and two-digit numbers where there are no remainders ; Roman numerals to 30 ; one-step oral problems involving denominative numbers and other factors which are real to the child.

Grade IV: numeration and notation continued over 10,000 ; development of speed and accuracy in addition, subtraction, multiplication and division ; using checks ; addition of five-digit numbers to six addends; subtraction of numbers with five-digit minuends; multiplication and division of five-digit by two-digit numbers; short division with divisors to 9; tables of time, distance, capacity, and currency continued; addition and subtraction of mixed numbers involving such fractions as $^1/_2$, $^1/_4$, $^1/_6$, $^3/_8$, $^5/_6$, $^7/_8$; knowledge of the ton, mile, bushel, pounds in a ton, feet in a mile, pecks in a bushel; Roman numerals to 100; recognising the square, rectangle and triangle; one-step and simple two-step problems, chiefly orally.

Grade V: four fundamental operations continued, accuracy and rapidity being stressed; logical procedure in solving problems—steps must be followed and become part of a pupil's habits so that he is enabled to think through his problems in an orderly fashion; reading and writing numbers to millions; factors, measures, multiples and cancellation; tables continued to include the simple facts of square measure; simple reduction and simple problems involving denominative numbers; addition, subtraction, multiplication and division of common fractions; addition, subtraction, multiplication and division of decimals to hundredths; Roman numerals to 500; acquaintance with accounts; area of rectangle; solution of one- and two-step problems both oral and written from data within the experience of the class.

Grade VI: four fundamental operations continued, accuracy and rapidity being stressed; reading and writing large numbers; fractions continued—mixed numbers and complex fractions; addition, subtraction, multiplication and division of decimals continued; Roman notation completed; tables of denominative numbers completed, extended to units of square measure, volume, etc.; reduction and work involving short problems in addition, subtraction, multiplication and division of denominative numbers; meaning of per cent; changing common and decimal fractions to per cent; finding the per cent of a number and what per cent one number is of another; calculating discounts and making out bills and receipts; finding simple interest; reviewing area of rectangle and calculating the perimeter from data given; solution of one- and two-step problems from data within experience of the class.

Grade VII: development of speed and accuracy in fundamental processes with integral numbers, fractions, decimals and percentages; review of denominative numbers, fractions and decimals; application of percentage in simple business transactions; square root by factoring; simple interest continued; explanation of commission, taxes, and profit and loss, pupils doing simple problems; explanation of simple graphical representation; the rectangle and square, finding area, length and breadth when other factors are given; volume of rectangular solids; use of ruler, set square and protractor, drawing to scale; board measure.

Grade VIII: development of speed and accuracy in fundamental processes with integral numbers, fractions, decimals and percentages; review of denominative numbers, fractions, and decimals, extending the work in each, and giving problems involving the use of each; application of percentage in various business transactions of everyday life: extension of work involving commission, discount, taxes, and profit and loss; acquaintance with business forms; banking: deposit slip, bank cheques, pass book; simple interest: finding interest, principal, time and rate when other factors are given; promissory note: meaning and use of the note—time, days of grace, maker, payee; borrowing money from a bank, security, bank discount, proceeds, simple problems, the bank draft, commercial draft, uses and forms of each; paying money at a distance: cheque, bank draft, bank money order, post-office order, postal note for small amounts, express order, telegraphic money order, simple problems; insurance: fire, life, accident, burglary, automobile, etc. (specimen policies should be studied); duties and customs, pupils calculating duties on invoices of imported goods; square root, by factoring and the square root process; practice in making and reading graphs; elementary bookkeeping (personal and household accounts); reviewing rectangle and square; the circle, ratio of circumference to diameter; area of triangle.

Arithmetic is taught for its utilitarian value; what will not be used should not be taught, but what is likely to be used in later life should be taught to the point of complete mastery.

AIMS

The main objects are a) automatic skill in fundamental operations of addition, subtraction, multiplication and division; b) proficiency in applying these skills to the common number work problems of everyday life; c) interpretation of a problem so as to realise the actual information given, the question asked, and the necessary operations to be performed; and d) use of approximations and checks to test the results.

METHODS

It is recommended that teachers use the following: " Handbook to the Course of Study " (Nova Scotia); " Ontario Teachers' Manual of Arithmetic "; CLARK, OTIS and HATTON's " First Steps in Teaching Numbers "; SHEFFIELD and BROYN's " The New Canadian Arithmetics "; " Supplementary Arithmetic Exercises "; " Standard Achievement Tests and Accuracy Pads "; and C. C. GOLDRING's " Oral Arithmetic ".

There are textbooks from Grade V onwards.

Quebec

Catholic Schools

From the reply sent by the Catholic Committee of the Education Council

PLACE OF MATHEMATICS IN THE CURRICULUM

Under the heading of arithmetic, introduction to mathematics is given in all seven classes of Quebec's Catholic primary schools.

In classes divided into different sections, three hours a week is devoted to the subject in the 1st year, four hours in the 2nd year, and five and a half hours thereafter. In undivided classes, three and a half hours a week is given in the 1st year, four hours in the 2nd, 3rd, 4th and 6th years, five hours in the 5th year, and five and a half hours in the 7th year.

Geometry is not a separate subject at primary level.

SYLLABUSES

The purpose of teaching arithmetic in each class is as follows :—

1st year : gradual development of the idea of quantity in concrete fashion ; training a child to compare objects in regard to size and number ; fixing in his mind the value of numbers up to 20 ; giving him a vocabulary that meets his need to express what he has learnt ; making him see that he will have to use numbers in his life and must be sure of their value ; imparting to him an idea of addition and subtraction, and an understanding of their various combinations ; developing in him, right from the beginning, confidence and skill in the use of numbers ; teaching him to use money honestly and charitably in his everyday life.

2nd year : enriching and clarifying the idea of number in a child's everyday experiences ; intensive and extensive development of his vocabulary, as his knowledge grows and is increasingly applied ; enabling him to understand addition and subtraction and gain knowledge of their various combinations ; developing his interest, confidence and skill in the use of numbers, and his desire to know more.

3rd year : confirming the knowledge so far acquired and extending its application ; giving each child possession of the combinations of addition and subtraction ; explaining multiplication and division and their various combinations ; training a child to solve problems, with method, clarity and correctness of language, and order and neatness, in his written work ; showing him the part arithmetic plays in his life.

4th year: bringing more order into the four operations, on the basis of numeration, and more skill in their use; showing a child that life itself sets numerous problems; confronting him with concrete cases, personal experiences and real problems that incite him to look for solutions by means of his arithmetical knowledge; making him more appreciative of the usefulness of arithmetic to him in and out of school, and at home.

5th year: ensuring accuracy and developing skill with the operations, and understanding of them; numerous exercises on the solving of practical problems; common measures, and a mastery of simple calculations with them; an understanding of fractions and operations with them; simple calculations with fractions in common use; extended application of what has been learnt, and appreciation of its usefulness.

6th year: completing the study of fractions; developing ability to analyse, explain and solve problems, evaluate answers and check results; continued improvement in setting out written answers to problems; more varied applications of arithmetic to everyday life.

7th year: linking what has been learnt of percentage and geometry with other subjects and a child's everyday life; developing his sense of responsibility for, and pride in, good work; revealing the social role of arithmetic.

Teachers should make every effort to articulate arithmetic with other subjects, and thus make use of what the children already know, and enable them to realise that knowledge helps them to acquire further knowledge. The use of arithmetical knowledge in a drawing, geography, hygiene or science lesson, is much more likely to show the value of arithmetic than a speech on the subject.

AIMS

The purpose of teaching arithmetic in Quebec's Catholic schools is to give a child an everyday knowledge of arithmetic, enable him to understand the value of numbers and be accurate in calculating, establish in him a foundation for arithmetical knowledge, develop the proper mental attitude towards problems, and give him a practical knowledge of everyday transactions and personal and household accounts.

The teaching of arithmetic should also have educational value. Arithmetical work well done develops attention, mental suppleness and speed, confidence and absolute accuracy. It calls for a true appreciation of facts and quantities, and teaches patience, self-control, and a sense of logical sequence and practical necessities.

METHODS

The curriculum of elementary primary schools approved by the Catholic Committee of the Education Council includes instructions on general and special method.

The instructions on general method are as follows :—

" Care will be taken to adapt teaching to a child's powers of comprehension. Teachers should not go more quickly than his mental development allows. Children acquire confidence if the teacher is wise and waits for them to master a given topic before proceeding further.

" Work set should be difficult enough to stimulate effort, but difficulties should be so well graded and adapted to a child's rate of progress and actual capacity that he comes to regard a setback as something unusual and unexpected.

" Spasmodic tests do not suffice. Teachers should ascertain, by means of ' diagnostic ' tests, whether knowledge has been really assimilated. A child may be said to have mastered a given subject sufficiently well when he obtains about 80% of the marks in an examination covering all essential points and taken four to six weeks after the initial study. Going too quickly leads to one setback after another for the children, and to their increasing confusion ; arithmetical knowledge has its own inherent sequence.

" Teachers should take note of the procedures already learnt by their pupils. In our schools, subtraction is taught by taking away and borrowing, but if a teacher notices that certain pupils proceed in a different way, he should take care not to compel them to change. He must know how much his pupils have understood and retained of the previous year's work, before breaking fresh ground. He should go so far as to diagnose individual weaknesses and then apply the appropriate treatment until difficulties have been overcome and bad habits replaced by good ones.

" It is important for children quite early on to acquire habits of order, neatness and accuracy, and for them not to be satisfied unless they are morally sure that their work is set out without mistakes. Absolute mastery of the combinations of addition, subtraction, multiplication and division is for this reason fundamental. Pupils must also be shown how to check their work.

" Written calculations should be simple, orderly, and neatly done : rough work is not allowed in arithmetic. A child should set out his answer in such a way that it is easy to follow and understand his reasoning. The actual amount of a child's knowledge contributes far less to his development than his grasp of good methods of work. "

" Children should be taught to apply what they learn about quantities, time, space and measurements to the problems arising in their environment. They must be trained to realise the importance of accuracy for calculation, measuring and good and productive work, and the immense usefulness to them of arithmetic in their own lives and that of the family and the community. "

During the 1st year, work in arithmetic is mainly oral and sensory, and should spring from the children's games and other activities rather than from formal teaching. On this level, numerous objects (coloured counters, buttons, bricks, dominoes) and pictures are used, and, at a later stage, apples, paper, ribbons, string, stamps, measuring instruments, invoices and so on.

MISCELLANEOUS

The syllabus now in force was published in 1948. It was drawn up in such a way as to simplify and lighten as much as possible the old syllabus and give it a more flexible content capable of adaptation to individual teachers' methods, the ability of their pupils, and the needs of a particular environment. The new syllabus also makes possible the use of activity methods which allow for the free play of a child's powers, stimulate the growth of his natural interests, and thus induce him to like his school.

Protestant Schools

From the reply sent by the Office of the Director of Protestant Education, Department of Education.

PLACE OF MATHEMATICS IN THE CURRICULUM

Pupils normally begin the study of arithmetic at the age of six, in Grade I. About five periods a week are given to the subject in the elementary schools.

Geometry is not referred to.

AIMS

In elementary schools, the aims of teaching arithmetic are a) to enable a pupil to think in terms of order, size, quantity and number ; b) to develop understanding, accuracy, and speed in number processes ; c) to apply the results of thinking in quantitative terms to actual situations ; d) to cultivate the habits of care, order, and neatness in number ; and e) to aid in the development of such moral values as industry, honesty and initiative.

METHODS

Official suggestions concerning the teaching of arithmetic are given in the " Handbook for Teachers in the Protestant Schools of the Province of Quebec ". Among such suggestions are the following :—

" Arithmetic should be taught in all grades as a practical subject. It should never be divorced from situations which may actually be met in life. By constantly reminding himself of this fact the teacher will avoid problems which lie outside the learner's experience.

" Teachers should seek to discover the exact difficulties which trouble pupils. Very often they can be readily found and corrected at the time, but, if neglected, may prove a serious hindrance in more advanced work... To discover such difficulties some easily obtained diagnostic tests may be used if the teacher is unable to find them by ordinary observation.

" At the beginning of the work of each grade new and interesting problems and examples should be used for review, and some new work should be introduced... It is desirable, about the second or third week of each year, to give diagnostic tests so that the teacher may discover the individual weaknesses of the pupils. These should be re-taught and reviewed.

" Before introducing a new topic the teacher should make sure that the class is ready for the new work. "

" Continuous and regular drill or practice of the work of the previous grades is necessary in order to help the children to retain mastery. Drill is an essential and important part of the work of each grade. Mixed practice or maintenance drill on work previously learned should be given at *frequent* and *regular* intervals. "

The child's introduction to numbers is made through materials. These may include pencils, blocks, spoons, clothes pegs, boxes, milk bottle tops, counters, checkers, jacks or poker chips and sets of domino cards.

Lists of authorized textbooks and workbooks are published.

MISCELLANEOUS

A mathematics sub-committee was convened on April 3rd, 1947, for the purpose of reviewing arithmetic courses of study from Grades I-IX inclusive, and has now completed its study.

Saskatchewan

From the reply sent by the Department of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Mathematics are taught as a definite subject from Grade II onwards. In Grade I, an oral and informal introduction is given.

Geometry as such is introduced as part of the regular mathematics course in Grade VIII.

From about twelve minutes a day in Grade II to about thirty-six minutes in Grade VIII are devoted to mathematics.

SYLLABUSES

The main objectives for each grade are as follows :—

Grade I: it is expected that there shall be no formal teaching of arithmetic. Any number experiences of the children should be merely those arising from their normal classroom experiences in connection with other subjects and their play. The emphasis will be on vocabulary, and the child's vocabulary expressing number should develop as an outgrowth of his experiences, just as his general vocabulary does. There should be no drill on number facts.

Grade II: to add to the pupil's vocabulary with respect to quantity, size, position, form, Canadian money; to develop skill in counting to 100 by 1's, 2's, 5's and 10's, ordinals to tenth ; to teach reading and writing of numbers in figures to at least 100, and in words to 30 ; to develop control over easy addition and subtraction facts ; to develop skill in higher decade addition without bridging, column addition to the sum of 9 with no carrying (using one, two or more columns), subtraction of two-digit subtrahends from two-digit minuends with no borrowing ; to secure an understanding of the meaning of the simple fractions one-half, one-third, and one-quarter ; to teach the units of measurements set forth for the grade ; to develop skill in solving simple one-step problems involving the number facts which the pupils know ; to make original problems ; to establish habits of neatness, accuracy and checking of work.

Grade III: to secure accurate, automatic response in the use of the addition, subtraction, multiplication and division combinations as required in this grade ; to extend skill in counting (by 100's to 1,000, and by 1,000's to 9,000) ; to teach reading of numbers to 10,000, and writing of numbers to 1,000, in figures only, reading and writing of Roman numerals to 20 ; to develop skill in higher decade and column addition with and without bridging, and subtraction with and without borrowing ; to introduce multiplication by one-digit multipliers with and without carrying, and division by one-digit divisors without carrying or remainders ; to teach additional units of measurement as set forth for this grade ; to increase the pupil's ability to solve simple one-step problems and problems involving two arithmetical processes ; to strengthen habits of neatness, accuracy, and checking work.

Grade IV: a careful, systematic diagnostic review of the processes covered in Grades II and III, with necessary remedial treatment, diagnosis and remedial procedures being continued, at intervals, throughout the year, especially before taking a forward step in any process ; extension of subtraction to include five-digit numbers, borrowing in three columns introducing zero difficulties ; multiplication extended to examples involving four-digit multiplicands and three-digit multipliers ; division involving dividends of three to five digits and one-digit divisors ; notation extended to reading and writing numbers of six digits, Roman numbers to 50 ; measurement (common units of time, weight, length and capacity) ; fractions extended to include those with numerators other than unity ; simple reduction ; the solution of problems ; strengthening habits of neatness, accuracy, and of checking work.

Grade V : careful, systematic review and diagnostic treatment of previous grades' work ; development of long division, using only two-digit divisors ; extension of the work on notation ; addition and subtraction of simple fractions ; introductory work in decimal fractions ; extension of measurement ; improvement of ability to reason in arithmetic.

Grade VI : diagnostic review of previous work ; completion of the mechanics of division ; notation extended ; addition, subtraction, multiplication, and simple division of fractions ; decimal fractions and percentage (multiplication and division of decimals, elementary treatment only of percentage) ; mensuration of rectangle and square ; 100% accuracy in *all* mechanical operations ; definite work in practical problem-solving.

Grade VII : developing greater efficiency in the four fundamental processes in whole numbers, common fractions, and decimal fractions ; understanding the application of percentage in business transactions and social situations ; becoming familiar with the mensuration of the rectangle and triangle ; applying graphical representation ; a simple plan of keeping household and farm accounts ; becoming familiar with certain mathematical terms ; common methods of sending money ; simple banking ; bills and receipts ; drawing to scale.

Grade VIII : greater efficiency in the four fundamental processes ; to have the pupils understand the transactions involved in grain marketing and farm problems ; to familiarize the pupils with simple banking transactions ; to extend further the application of percentage in various business practices ; to teach the application of graphical representation ; to acquaint the pupils with simple electrical and water costs ; to teach instalment buying or deferred payment plan ; to teach the simple equation ; to introduce a study of geometry and mensuration.

In all grades, practical work is emphasized.

AIMS

In Grades II to VI the emphasis is placed mainly upon the acquisition of skills and the mastery of the fundamental processes. With this there is simple problem-solving related to the pupils' everyday social contacts, and also a variety of activities involving practical use of the facts and skills learned. Grades VII and VIII deal chiefly with the applications of arithmetic in the home and in the community.

METHODS

The attention of the teacher is drawn to the following considerations :—

a) In presenting the course outlined for one particular grade frequent reference should be made to the work of previous grades. It is just as important to retain and strengthen learnings and skills of previous years as it is to give new instruction.

b) Pupil activities which involve a high degree of child interest, because they are closely related to life, should be used as the basis of the work in arithmetic. The social significance of what is taught should go hand-in-hand with the development of expertness in computation.

c) Individual diagnosis is of the utmost importance. Tests for the purpose of discovering the exact nature of a pupil's failure should be given at frequent intervals. The pupil should review and drill *only what he does not know.*

d) Complete accuracy is essential. Speed, though desirable, is of secondary importance.

e) The habit of working neatly and carefully should be firmly established. Careless, untidy work, in book or on blackboard, is not to be tolerated.

Furthermore, the official programme suggests activities, problems and games for each unit.

The textbooks to be used are chosen by the Department with the help of the teachers and superintendents of schools.

STATE INSTITUTE OF EDUCATION * Govt. of West Bengal

CHILE

From the reply sent by the Ministry of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

What the children do, in Chilean infant classes (5-6 years), in connection with quantities, constitutes an introduction to mathematics. Systematic teaching begins in the 1st class (children of seven years old) of the primary school.

In the official curricula, arithmetic and geometry come under the heading of *matemáticas* (mathematics), to which four hours a week are devoted in each of the six classes of the primary school. In the first three classes (children of seven to nine years of age), geometry is taught on the occasions when it may help the children to understand their surroundings. It makes its appearance as a separate subject only in the 4th class (children of ten years of age).

SYLLABUSES

The aims of teaching set for each class will perhaps serve better than a list of the points dealt with in the syllabuses, to give some idea of the importance given to the subject.

These aims are as follows :—

1st class: Arithmetic : to bring order into a child's experiences ; to develop his interest in numbers through the discovery of their usefulness in everyday life ; to enable him to express numerical ideas through the use of an adequate vocabulary ; to give him opportunity through play and work to use and formulate concepts ; to give him increasing command of the numbers corresponding to his age and experience ; to introduce him to the use of natural and conventional measures. Geometry : to bring order into a child's observations and experiences by linking them with particular forms and sizes.

2nd class: Arithmetic : to interest a child in acquiring the initial skills necessary to a mastery of the four operations ; to give him the vocabulary he needs to express quantitative ideas ; to train him in habits of orderliness and cleanliness necessary for accurate written work ; to teach him a sense of responsibility and duty, and the use of notions got from everyday life. Geometry : to help a child to appreciate and measure lengths, and to appreciate and compare the forms and positions of volumes, surfaces and lines.

3rd class: Arithmetic : to improve a child's skill in the processes of addition, subtraction, multiplication, and division with remainder ; as far as possible to avoid his forming bad arithmetical habits ; to develop his ability to do mental arithmetic ; to give him practice in making use of notions got from everyday life. Geometry : in a concrete form to represent solids, figures and positions ; to enable pupils to understand the main characteristics of figures and solids, and to grasp certain relationships (of magnitude, position, etc.).

4th class: Arithmetic : to give pupils mastery of the four operations with whole numbers ; to integrate knowledge and skills acquired in the previous classes ; to enable pupils to analyse and solve problems ; to arouse their interest in the usefulness of numbers to society. Geometry : to apply knowledge and skills acquired to solids, surfaces and lines ; to systematise knowledge.

5th class: Arithmetic : to confirm and develop pupils' mastery of the four operations with whole numbers, and their skill in the use of vulgar and decimal fractions ; to enable them to solve further problems ; to increase their interest in the social applications of arithmetic. Geometry : to systematise knowledge and skills in connection with magnitudes, forms, and the positions of solids, surfaces and lines ; to arouse interest in the social applications of geometry.

6th class: Arithmetic : to give a child mastery of the four operations with vulgar and decimal fractions ; to enable him to solve complicated problems ; to inspire in him a desire to become familiar with institutions, industries, professions and the like in his neighbourhood and appreciate their social and economic value ; to teach him to carry out common commercial transactions and understand their mechanism ; to give him mastery of economic ways of doing arithmetic, and of verification and proof ; to give him skill in generalizing ; to give him the mathematical knowledge which every good and efficient citizen must possess ; to enable him to understand and make use of statistics and representational graphs ; to give him the power to apply arithmetic in the economic life of his school, home and city. Geometry : to give a child skill in the use of fundamental knowledge of solids and their salient characteristics ; to enable him to use geometry to social ends.

At all levels, as and when the children learn a given arithmetical or geometrical procedure, they are asked to apply it to the solution of problems arising out of school activities and practical life.

According to the official instructions, teachers should take every opportunity that comes their way to articulate their teaching of mathematics with that of other subjects. The social sciences, in particular, demand the use of arithmetic for their physical, political, economic, ethnographic and other aspects. Nature study provides suitable material for introducing number and form. Handwork, gardening, feminine handicrafts and the like also give frequent opportunities to formulate concepts and acquire mathematical skills.

With regard to the time devoted to them, mathematics come after the mother tongue, and so take second place in the time-table. This clearly indicates the importance attached to the subject. Four subjects are considered as fundamental in Bolivia, namely the mother tongue, mathematics, natural science and the social sciences. To be admitted to an intermediate school, candidates must pass an examination which in general may be said to be a test of their knowledge of the mother tongue and mathematics.

Aims

The official syllabuses suggest that in teaching mathematics, the teacher's aim should be to give a child increasing power to understand the quantitative aspects of his environment and to react intelligently to problems concerning quantities arising in individual or community life.

Methods

It is also officially suggested that teachers should distinguish two fundamental and characteristic aspects of the teaching of mathematics, firstly the scientific aspect concerning knowledge and the search for truth, and secondly the technical aspect the aim of which is the practice and acquisition of immediately utilisable skills. These two aspects give rise to the use of two distinct but correlated teaching procedures, firstly the method of science the aim of which is to give a child the knowledge and mathematical concepts wherewith to understand the quantitative aspects of his environment, and secondly the method of technique whereby a child may be taught the habits and skills necessary for calculating quickly and accurately.

The stages and activities that characterise these two procedures may be summed up as follows :—

Method of Science	Method of Technique
Stage : Formulation of concepts.	**Stage :** Understanding mathematical mechanisms.
Activities : Perception, observation, choice, appreciation, measurement, numerical composition and decomposition, counting, taking away, comparing, association, grouping, classifying, formulating orally and in writing.	**Activities :** Association, identifying, copying and dictation, reading, grouping, numerical composition and decomposition, verification.

METHOD OF SCIENCE	METHOD OF TECHNIQUE
Stage : Fixing of concepts.	**Stage :** Practice with mathematical mechanisms.
Activities : Identifying, grouping, completing (and, if necessary, repetition of the activities of the formulation stage).	**Activities :** Reading, copying and dictation, oral exercises, calculating, written operations, verification, measurement, buying and selling.
Stage : Verification of concepts.	**Stage :** Application of mathematical mechanisms.
Activities : Finding concrete and graphical examples, deductive observation, problem projects.	**Activities :** Reading and writing, numeration, annotating numerical data, observation and investigation of quantitative data, execution.

According to official instructions, the following material should be used in the teaching of mathematics :— real objects (natural and man-made), drawings and photographs, concrete and graphical symbols. According to its purpose, such material may be classified as follows :— a) material for giving children a broad objective basis for scientific knowledge ; b) material for developing the concrete expression of concepts ; c) material for enabling children to fix and revise activities concerning mathematical techniques.

Activity is considered to be the essential means, especially in the first two primary classes, of making a lesson living and concrete. Teachers are completely free as to what educational games they choose. They have an immense store in this connection in the national folk-lore and various foreign folk-lores, in commercial activities—shopping and marketing, for example—in athletic competitions and events, and in the ordinary or invented games of childhood.

There are no official textbooks or lists of problems. Teachers should themselves make up exercises and problems on the basis of the suggestions contained in the syllabuses. The latter, in fact, indicate how the difficulties may be graded, and suggest for each problem a great variety of activities and the kind of results it is desirable to obtain. Standardised tests are used to estimate such results.

Teachers are also officially recommended to devote three weeks to the organisation of their class and their teaching, before beginning on the syllabus itself.

During these three weeks, a teacher gets to know his pupils through questioning them, watching them working, and giving them tests of the " knowledge-inventory " type. He can thus discover what they have really grasped from the previous year's work, discover deficiencies and weak points, and determine what each child will have to revise, correct or learn.

On the basis of the knowledge gained in this way, a teacher can then proceed to divide his pupils into homogeneous groups, and adapt the syllabus to individual differences in ability, interests and inclinations, with a view to obtaining better results in his work.

Miscellaneous

Mainly in the last ten years, an attempt has been made to rid the teaching of mathematics of the routine, mechanical and abstract nature with which it was invested. With this end in view, changes were made in both the general and particular objectives of the subject, and in the methods and materials used.

The changes in general aim have made it possible to stimulate a child's psychological development, and to give him greater understanding and activity in regard to social problems.

The particular objectives of mathematics in each primary class were re-defined, account being taken of pupils' potentialities and the needs and interests proper to each stage in their development.

The teaching materials were chosen by various committees of specialists and teachers, in the light of their training and educational value, and the frequency of their applicability to social problems. Such materials were also graded in respect of certain difficulties, and with constant care to build each new concept or technique on the firm foundation of already acquired knowledge or skill. They were expected, moreover, to help in the transition from purely local to universal interests.

The endeavour was also made to make the teaching of mathematics only one of many ways of guiding a child's activity into the desired direction, while maintaining an immediate unity and social purpose in keeping with the true laws of learning.

The following is a list of the most recent publications on the teaching of mathematics :—

NAVEA, Daniel : " La enseñanza de las tablas de multiplicar. "
VALENZUELA, D., RIQUELME, B. and GOMEZ, L. : " La enseñanza de las matemáticas en el primer grado de la escuela primaria. "
MINISTERIO DE EDUCATION PUBLICA, DIRECCION GENERAL DE EDUCACION PRIMARIA : " Planes y programas de estudio para la educacion primaria ".

Official instructions also recommend teachers to read the following :—

BUSTOS, Oscar : " Principios y Técnica de la Escuela Activa " (Quevedo, Santiago, 1944). BUSWELL, BROWELL and JOHN : " Daily Life Arithmetics : Teacher Manual " (Ginn, New York). DIRECCION GENERAL DE EDUCACION PRIMARIA : " La Escuela Primaria y los

Problemas Económicos Nacionales" (Circular No. 27, Santiago, 1927); "Programa para la Formación del Buen Consumidor" (Circular No. 52, Santiago, 1947) ; " Orientaciones socio-educativas " (Circular No. 49, Santiago, 1944). KUHNEL, Johannes : " Orientaciones Modernas en la enseñanza de la Aritmética " (translated by Margarita Johow and published by the Departamento Técnico de la Dirección General de Educación Primaria, Folleto No. 6, 1929). LICEOS RENOVADOS : " Cartilla del Consumidor " (Talleres Gráficos " La Nación " S.A., Santiago, 1947). LEE and LEE : " The Child and his Curriculum". MARIN, Oscar : " Objetivos de la Enseñanza de las Matemáticas " (article from " Renovación ", organ of the Comisión Gradual de la Educación Secundaria, 1946). " Programa Oficial para las Escuelas Primarias de Chile " (1929). DEPARTMENT OF PUBLIC INSTRUCTION : " A Teacher's Guide Book and Course of Study " (Trenton, New Jersey, 1930). " Programa para las Escuelas Primarias de los Estados Unidos əp Venezuela " (1944). REED, B. and HOMER : " Psicología de las materias de enseñanza primaria " (Editorial Hispano-americana, Mexico, 1942). RIVLIN and SCHUELER : " Enciclopedia de la Educación Moderna " (Losada, 1946). RUDE, Adolf : " La enseñanza de las ciencias exactas y naturales " (Buenos Aires, 1939). RADICE, Lombardo : " Didáctica " (Buenos Aires, 1933). SCHMIEDER, A. J. : " Didáctica General " (Losada, Buenos Aires, 1942). SOCIETY OF STUDY OF EDUCATION : " The Twenty-ninth Yearbook " (New York). THORNDIKE, Eduardo Lee : " Las Aritméticas de Thorndike " (Rand McNally, New York, 1926). UPTON, Clifford : " Adventure in Arithmetic " (Volumes I to V, American Book, Chicago). VALENZUELA, D., RIQUELME, B. and GOMEZ CATALAN, L. : " La enseñanza de las Matemáticas en la Escuela Primaria " (Santiago, 1945) ; " Esquemas para la Planificación del Trabajo Escolar ".

COLOMBIA

From the reply sent by the Ministry of National Education

PLACE OF MATHEMATICS IN THE CURRICULUM

In Colombia a child's introduction to mathematics begins on his entry into the infant school at the age of four or five. It takes the form of exercises in comparison (big, little and the same ; heavy and light ; thick and thin ; wide and narrow ; long and short ; much and little, etc.), and exercises with the natural measures, and the four operations with concrete quantities up to 10.

In the primary schools a subject called *enseñanza matemática* (mathematics) is studied from the age of six or seven years onwards, for four hours a week in the first two classes and five hours in the 3rd and 4th classes.

SYLLABUSES

The principal matters dealt with in the syllabuses are as follows :—

1st year: the four operations with whole numbers up to 100 and with easy fractions (halves, quarters, eighths), natural measures, coins and notes being the concrete things with which the operations are done ; recognition of geometrical solids (cube, prism, pyramid, cone, sphere, cylinder) and comparison of them with objects having similar shapes.

2nd year: Arithmetic : the four operations with whole numbers up to 1,000, with decimal fractions (*pesos* and *centavos*, metres and centimetres), and with simple fractions (halves, quarters, eighths, thirds, sixths, ninths, fifths, tenths), the divisors and multipliers being limited to one-digit numbers. Geometry : revision of the solids studied during the 1st year, and gaining from them notions of the square, rectangle, angle, line, circumference, circle and so on ; introduction to the study of plumb-line and level in connection with the classification of straight lines ; use of ruler and set-square for comparing right angles and constructing rectangles.

3rd year: Arithmetic : the four operations with whole numbers up to 100,000, with decimal fractions (*pesos* and *centavos*, metres and centimetres, litres and grammes and introduction to measures of area and volume), and with ordinary fractions (with concrete, graphical and numerical examples). Geometry: circumference, degree, triangle and quadrilateral.

4th year: Arithmetic : the four operations with whole, decimal, fractional and mixed numbers up to 1,000,000 ; percentage, interest and discount, bills of exchange, cheques, money orders, receipts, bills. Geometry : regular and irregular polygons, circumference, relationship between circumference and diameter ; volume of cubes, parallelepipeds, cylinders and pyramids.

At all levels practical exercises take first place, it being a good rule of teaching that principles be arrived at through their applications. Comparing the lengths of rivers and of road and rail systems, population density, altitudes, censuses, agricultural production, hydrocarbonates, precious metals, salts, costs of production, buying and selling, banking operations—all these offer opportunity to ask questions leading up to the concepts the children are formulating.

Mathematics is the most important subject in examinations and the selection and grading of pupils.

AIMS

The teaching of mathematics in Colombia's primary schools has two aims. The first is the formal one of developing the ability to think methodically, to reason, and to make deductions, and the second is the practical one of getting good results, through the application of formal ability to the quantitative aspects of everyday life.

METHODS

There are official recommendations to teachers for all subjects. They suggest that teaching be graded and so organised that it is always in harmony with the surroundings in which it is given, and adapted to the children's age and class. Teachers are not obliged to carry out these recommendations, but as they find that they tend to eliminate all deadness and mechanical formalism from their lessons, the majority of them do in fact do so.

Teaching should have a concrete basis, and this calls for the use of materials. Thus the various things in a child's environment serve as raw materials for formulating fundamental concepts of number. Once these concepts have been formed on a concrete basis, then a teacher can begin to use coins and notes (real ones or ones made by the children), natural measures, trade measures and so on.

In both infant and primary schools, activity is the key to teaching. The educational activities and games used in Colombia are so varied that it is difficult to classify or list them. The following may be given as examples: postmen's games, going up and down the stairs, buying and selling in the school shop, dominoes, lotteries; making coins and notes and exchanging equal amounts; estimating quantities by hearing, touch and sight (to develop the senses and the ability to formulate quantitative concepts). All a child's activities are used to increase his appreciation of sizes and quantities.

The Ministry advises teachers to make use of a textbook. Textbooks are chosen according to estimates of their value by the national education inspectors, who base their judgments on the results the books give in practice. The Ministry has textbooks written and revised by making direct contracts with authors. Such books are subsequently issued to the official schools, and preference is always given to works of the greatest educational promise. Then, finally, specialist mathematics teachers draw up provisional textbooks for each class, which achieve publication as and when they are completely adapted to the children's abilities and interests.

MISCELLANEOUS

In 1941 the Ministry issued a new mathematics syllabus which was more in keeping with school needs and teachers' levels of training.

One recent publication should be noted, namely " Mi cuaderno de aritmética " by Macedonio VALDERRAMA and E. P. VALDERRAMA (Bogota, Editorial ABC, 1948). The authors have founded an institute to apply and improve their method. The most original of their procedures is introducing a child at the infant school to all four operations at once.

CZECHOSLOVAKIA

From the reply sent by the Ministry of Education, Science and Arts

PLACE OF MATHEMATICS IN THE CURRICULUM

A subject called " arithmetic and geometry " is taught in Czechoslovakian primary schools from the 1st class (children of six years of age) onwards. Three hours a week is devoted to it in the 1st class, and four hours a week thereafter.

SYLLABUSES

The main items in the syllabus are as follows :—

1st class : addition of quantities up to 10 ; numeration and notation up to 100.

2nd class : addition and subtraction of quantities up to 100 ; introduction to multiplication tables ; knowledge of some solids and geometrical figures ; common weights, and measures of length and capacity.

3rd class : addition and subtraction with tens and units (totals not exceeding 1,000) ; multiplication tables ; numeration and notation up to 10,000 ; written addition and subtraction ; quadrilaterals and calculating their perimeter ; acute angles and right-angles.

4th class : addition and subtraction of two-digit numbers, hundreds and thousands ; division of a two-digit number by a one-digit number; numeration and notation up to 1,000,000 ; written multiplication and division.

5th class : addition and subtraction with remainder ; decimals ; addition, subtraction and multiplication with decimals ; division with two-digit divisors (units and tens) ; operations with fractions and compound numbers ; lines and angles ; polygons and calculating their perimeter.

In all classes, half the time given to the introduction to mathematics should be reserved for practical exercises.

In the lower classes, learning vocabulary is especially important, and arithmetic lessons are articulated with those on the mother tongue. Mathematical ideas are later made use of in geography, physical training and drawing.

There are no yearly or school leaving examinations in Czechoslovakian primary schools, but a pupil who has not completed the mathematics syllabus has to stay down for another year.

AIMS

Arithmetic and geometry in primary schools is expected to help in training a child's power of judgment, and to teach him accuracy, order and economy of effort in his work. The subject should also enable him to grasp the value and problems of economic planning.

METHODS

There are no official recommendations as to how arithmetic should be taught. The most commonly used methods are of an inductive kind. Teaching materials consist of draughts, fruits, games with money and notes, ball-frames and actual weights and measures. In the top classes, tables and graphs are also used.

In nursery-infant schools, a first introduction to mathematics is given in the form of games. At primary level, teaching begins with concrete things, and leads on to the power of numerical abstraction.

An arithmetic textbook is used in all classes. Textbooks are revised and re-written by a specialist committee at the Institute of Educational Research, and are subject to the Ministry's approval.

MISCELLANEOUS

Recent modifications in the teaching of arithmetic chiefly concerned the content of problems, which were adapted to the country's new economic structure. It should also be noted that, as regards written multiplication, the multiplier is now put under the multiplicand instead of to the right of it, as was formerly the case.

DENMARK

From the reply sent by the Ministry of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Introduction to mathematics begins in Denmark in the primary school, with children of seven years of age, in lessons on arithmetic. Five to six hours a week, according to the level of the class and type of school, are devoted to the subject.

Geometry is not a separate subject at primary level, and is included in the arithmetic syllabus.

SYLLABUSES

The primary arithmetic syllabus is chiefly a matter of the four operations, proportion and proportional parts, and the calculation of interest and areas.

Great importance is attached to practical exercises, but the syllabus at present in force does not envisage an introduction to mathematics in any lessons other than those on arithmetic.

AIMS

From the arithmetic lessons in the primary school, a child should gain a clear idea of number ; speed, accuracy and confidence in making calculations ; and the necessary skills for solving problems arising in everyday life.

METHODS

Recommendations on method are made in the official syllabuses.

As far as arithmetic is concerned, a normal lesson should consist of an introduction, then oral and memory exercises, and finally written work. Teachers should endeavour to work out a detailed, well-graded scheme of work.

In the lower classes, Montessori apparatus is used, and the ball-frame and various objects.

Teachers are expected to use a textbook.

MISCELLANEOUS

Among official publications giving suggestions as to method, mention should be made of "Undervisningsvejledning for den Eksamensfri Folkeskole" (Copenhagen, 1943).

DOMINICAN REPUBLIC

From the reply sent by the Secretary of State for Education and Arts

PLACE OF MATHEMATICS IN THE CURRICULUM

The teaching of arithmetic begins in the 2nd class (children of eight years of age) of the primary school. In this and the succeeding classes five hours a week are devoted to the study of *matemáticas* (mathematics).

The special teaching of geometry begins in the 5th class and continues up to the end of the primary school in the 8th class.

SYLLABUSES

The mathematics syllabus for primary schools comprises mental and written arithmetic, currencies and measures, the recognition and study of solids and figures, and the solving of problems.

The same questions are studied in all classes, but in a progressively complete and thorough way.

Arithmetic exercises and solving problems are the immediately practical aspects of the subject. Other subjects, moreover, give frequent opportunity for exercises calling for the application of knowledge. When the children are engaged on *estudios sociales* (social studies), for example, the distances between towns can be calculated, altitudes and depths compared, and the geographical coordinates investigated. Similarly, the physics syllabus, with its problems involving the use of scales, its construction of apparatus, etc., can only be learnt in connection with mathematics.

Mathematics and the mother tongue are the basic subjects in the examinations that conclude lower primary schooling *(certificado oficial de suficiencia en los estudios primarios elementales)* and upper primary schooling *(certificado oficial de suficiencia en los estudios primarios superiores)*.

AIMS

The aims of teaching mathematics in the primary schools of the Dominican Republic can be deduced from a study of the rules governing the syllabus and nature of the various examinations, and the conditions of entrance to the different classes.

At all levels, an examination should be a test, within the limits of the respective syllabus, of, in arithmetic, knowledge of arithmetic, ability to perceive and analyse problems arising in everyday life, and knowledge of the basic principles, and, in geometry, the use of instruments (ruler, set-square, protractor, compass, etc.), and ability to perceive and solve practical problems.

METHODS

For training in arithmetic, a graded series of exercises has been prepared for the use of teachers, from the 3rd class onwards. The instructions concerning their use contain the following especially interesting points :—

The exercises are graded according to kind and degree of difficulty, and the children must have mastered one set of them before going on to the next. In repeating the same exercises, pupils not only test their knowledge, but at the same time acquire mechanical skill and speed ; for this reason all the exercises are of equal importance and none of them should be neglected. Children should give the same care to the actual writing of the numbers as to finding the answers.

Teachers are recommended to give their pupils a great number of very carefully graded exercises (the ones in the official series will serve as models for others that teachers can make up themselves). Doing numerous exercises on subtraction and multiplication, for example, is very good preparation for division.

The various subjects should be articulated, and arithmetic and geometry should remain associated with each other.

The greatest importance is also attached to a child's obtaining a clear idea of measurement and an exact knowledge of the units in common use, during his primary schooling. He should be given numerous exercises on them, from simple perception series up to the finding of areas in the 6th class, drawing plans to scale in the 7th class, and determining capacities and volumes in the 8th class, with abundant practice throughout in drawing up tables of the principal units of length, money, time, weight and capacity.

The teaching materials used for mathematics are generally made in the handwork classes with the help of the handicraft and domestic economy schools attached to primary education.

There are very few kindergartens in the Dominican Republic, and so they cannot be deemed to form part of its educational system. Most children, therefore, do not begin mathematics before coming to the primary school.

Textbooks should be used, according to official instructions, and certain professional bodies publish and keep up-to-date a selected list.

MISCELLANEOUS

Teachers recently received recommendations from the Secretary of State, for their help and guidance in the teaching of mathematics.

ECUADOR

From the reply sent by the Ministry of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Children learn to count and get notions of dimension and shape through the games used in Ecuador's nursery-infant schools, where they go at the age of four years. Arithmetic proper begins only in the first class of the primary school.

The time devoted each week in primary schools to the subject called *cálculo, medida y forma* (arithmetic, measurement and form) is divided up as follows :—

	Arithmetic	Geometry	Metric System
1st class	5 hours	—	—
2nd class	5 hours	—	—
3rd class	3 hours	1 hour	1 hour
4th class	3 hours	1 hour	1 hour
5th class	3 hours	1 hour	1 hour
6th class	3 hours	1 hour	1 hour

It will be seen from this table that children study geometry from the 3rd class onwards, from the age, that is to say, of eight years.

SYLLABUSES

The main points of the " arithmetic, measurement and form " syllabus are as follows :—

1st class: revision of the numerical concepts formed during pre-school education ; numeration, addition and subtraction of numbers up to 20 ; concepts of double, half and quarter with the same numbers ; concepts of units, tens and hundreds up to 100 ; notation up to 100 ; signs used for the four operations ; natural, popular and metric measures, and exercises with simple everyday examples ; forming concepts of shapes (square, rectangle, triangle, cube, sphere) ; recognition of forms in things (objects in the home and school, including furniture, and in the street and nature) ; problems on buying, selling and dividing taken from the children's everyday experience, with numbers and quantities up to 20.

2nd class: addition and subtraction up to 100 ; making multiplication and division tables ; exercises on the four operations up to 100 ; fractions (half, quarter, third, fifth, sixth and tenth) ; sum and difference with multiples of 10 and 100 ; numeration up to 1,000 ; deeper study of popular measures (league, quarter-league, *vara*, span, foot, inch, *fanega, arroba*, pound, ounce) ; subdivisions of the year down to seconds ; names of the days and months ; telling the time ; dozens and gross ; decimal measures (metre, litre, kilogram) and their multiples and sub-multiples ; the national currency and its fractions ; knowledge of geometrical solids (cube, sphere, cylinder, pyramid) and forms (square, rectangle, triangle, circle and circumference), drawing such figures, and recognising them in objects.

3rd class: numeration up to 1,000 ; written addition and subtraction ; constructing and memorising multiplication tables ; multiplication and division, problems ; Roman notation ; fractions from halves to tenths ; popular measures ; relationship between the metre and the vara, and the pound and the gram ; divisions of time ; regular and irregular polyhedrons ; angles and degrees ; square metre and application to measurements ; scale drawing.

4th year: decimal numeration and notation ; the four operations with decimals ; systematic study of decimal measures ; compound numbers and operations ; simple problems on the rule of three ; systematic study of the cube (surfaces, arrises, angles) ; measures of area and their applications ; calculating areas (squares, rectangles, triangles).

5th year: notation of numbers comprising whole numbers and fractions ; vulgar fractions (concept, notation, properties, reduction, operations) ; powers and roots ; the rule of three and percentages with easy problems ; the square metre and its equivalents ; concept and calculation of perimeters and areas ; geometrical drawings of squares, rectangles, triangles, rhombuses, parallelograms and trapezia, and calculating their area and perimeter ; the circumference and the circle.

6th class: the different rules for facilitating mental arithmetic ; ratios, proportion, simple and compound rule of three ; interest ; proportional division ; profit and loss ; clubs ; mixtures ; the national currency ; the function of banks ; notes, cheques, coupons, bills of exchange, savings accounts ; exchange ; forming a school cooperative ; benefit societies ; calculating surface-area of solids ; surface of spheres ; calculating volumes ; densities ; different ways of determining weight.

About one-third of every lesson should be spent in practical exercises relating to everyday life. The various subjects in the curriculum may also provide material for mathematical problems. Observing meteorological changes, for example, may furnish an opportunity to work out daily, weekly, monthly or yearly average temperatures, or to draw graphs showing variations in temperature. The relative areas of the continents may also be represented with rectangles of equal base, actual distances calculated from maps, relative altitudes shown with vertical lines, and the time estimated which separates two events in history.

Mathematics and Castilian are the two subjects which count most for promotion.

AIMS

The curricula at present in force state that the aim of the teaching of mathematics is to enable pupils to check, mentally and in writing, the operations in common use concerning " number, measure and form ".

METHODS

There are official recommendations concerning the teaching of arithmetic. They suggest that teachers should attach quite special importance to exercises in mental arithmetic on data taken from the various subjects the children are learning. Arithmetical rules should also be deduced by the children themselves from work with such data. For teaching arithmetical skills, teachers should give their pupils work with abstract numbers. The syllabus should be gone through in logical sequence, the unknown always being based on the already known.

In teaching geometry in the upper classes, teachers are recommended gradually to move away from concrete things and pass on to analysing forms, calculating and construction, and constant applying of knowledge. In the lower classes, on the other hand, they are recommended to teach the subject almost always incidentally. Handwork and drawing are invaluable in this connection.

The materials used in the teaching of mathematics include ball-frames, geometrical solids in wood or cardboard, weights, counting sticks, beans and marbles. Such materials are made at the school itself or come from the locality.

Games are quite often incorporated in the teaching, and children then become customers and assistants in a shop, colleagues in a business, and so on.

There are numerous textbooks. They include problems on Ecuador's commerce, industry, history and geography. Each school usually chooses its own textbooks, the government limiting itself to recommending through the Ministry of Education those which it considers most suitable.

In many primary schools, more especially in the towns, use is made of Argentinian, Uruguayan and Mexican textbooks.

FINLAND

From the reply sent by the Ministry of Education

As a general rule compulsory schooling takes place in Finland in the " general basic school " and lasts for eight years of roughly two hundred work days each. In country districts, however, lessons in the eighth year are given in the evening and may therefore be fewer in number. Children usually begin at such a school during the year of their seventh birthday.

PLACE OF MATHEMATICS IN THE CURRICULUM

Arithmetic and geometry are taught from the 1st class (children of six to seven years of age) onwards. The number of hours devoted to them is fixed by the headmaster of each school in accordance with the teachers' suggestions, and must meet with the inspectors' approval. Generally speaking it amounts to three or four hours a week in the 1st and 2nd class, four or five hours in the 3rd, 4th and 5th class, four hours in the 6th class, three or four hours in the 7th class, and two or three hours in the 8th class.

Geometry becomes a distinct subject only from the 5th class onwards. Before this class children are taught the vocabulary of geometry (horizontal, vertical, square, triangle, circle, cube, etc.) mainly in study of surroundings and drawing lessons.

SYLLABUSES

The principal points in the syllabuses are as follows :—

1st class : numeration up to 20 ; the four operations with the same numbers, mainly in the form of mental arithmetic.

2nd class : numeration up to 100 ; the four operations with the same numbers, divisors being at least 5 ; currencies ; notions of time ; measures (mms, cms, dms, ms, dlts, lts, grms, kilograms) ; units, dozens and fractions (halves, thirds and quarters).

3rd class : written addition, subtraction and multiplication with whole numbers ; division with divisors up to 9 ; multiplication tables.

4th class: the four operations with multiples of ten; first notions of addition and subtraction with decimal numbers; measures of length, capacity and weight.

5th class: decimals; the four operations with decimals; ordinary fractions and conversion into decimal fractions; measures; first notions of geometry.

6th class: the rule of three; interest and discount; bisection of angles and finite segments; construction of perpendiculars; areas of squares, triangles, rectangles, parallelograms, rhombuses, circles; volumes.

7th class: revision of simple and decimal fractions; practical problems.

8th class: arithmetical problems on proportional division, etc; bookkeeping.

In all classes a large part of the time is spent on practical exercises (mental arithmetic especially). Notions of mathematics are also given incidentally in other lessons. In handwork, for example, the children themselves have to calculate the number of planks needed for the table they are going to make, and similarly in agriculture they may have to estimate the costs of running a farm or cultivating a garden.

In the " general basic school ", mathematics are regarded as the most important subject after the mother tongue.

AIMS

Arithmetic is taught in the " general basic school " in order to fit children for everyday life. It is also considered of use for developing certain abilities (reflection, estimating, taking care).

METHODS

There are no official instructions in Finland concerning the teaching of arithmetic in the " general basic school ", but certain government committees have published suggestions to which teachers may refer.

The function of arithmetic being a practical one, it is deemed of the utmost importance that exercises should be taken from the environment rather than from textbooks. The volumes and areas to calculate, for example, should be those of the school premises or fields.

Opinions differ in Finland as to the best way to teach fractions. Some persons believe that teaching should be limited to decimal fractions, others hold that it should begin with ordinary fractions.

It is generally agreed that a child's first approach to mathematics should be through perception, and that the teaching materials used in the first classes should therefore consist of numerous small objects. At different levels, the ball-frame, ruler, scales and weights, litre, decilitre, compass and so on are used. Various games such as buying and selling also help the children in acquiring notions of mathematics.

The books used in the schools are those approved by the Ministry. No authority is required for the publication of a textbook. In addition to, or replacing, a textbook, children often have their own notebook.

MISCELLANEOUS

Teachers enthusiastically undertake to experiment with the new methods.

A recent work on the teaching of mathematics is Kaarlo SAARIALHO's " Laskennonopetuksen peruskysymyksiä " (Some Fundamental Problems of the Teaching of Arithmetic) (Helsinki, 1938).

FRANCE

From the reply sent by the Ministry of National Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Introduction to mathematics begins in France in the upper section of the nursery-infant school, with children of about five years of age, or (in districts where there is no nursery-infant school) in the preparatory class of the primary school, with children of about six years of age.

The heading of arithmetic *(calcul)* in the official syllabuses really covers three closely coordinated and mutually helpful subjects: arithmetic proper (numeration, operations, etc.), the metric system (standard measures of length, capacity, weight, area and volume), and geometry.

Three and three-quarter hours a week are devoted to arithmetic in the preparatory class (children of 6-7 years of age) and the elementary class (7-9 years), and five hours a week in the middle class (9-11 years), upper class (11-12 years) and top class (12-14 years).

Geometry, studied in close connection with arithmetic proper and the metric system, begins in the elementary class, with children of seven years of age.

SYLLABUSES

The principal points in the primary arithmetic syllabus are as follows :—

Preparatory class (6-7 years) : concrete study of numbers up to 5, 10 and 20 ; formation and decomposition of numbers ; notation ; use of coins and notes of 1, 2, 5 and 10 francs ; use of the decimetre ruler and double decimetre ruler marked in centimetres ; numeration up to 100 ; tens and fives counted in groups of two, five and ten ; use of chessboard with 100 squares ; the tape-measure ; concrete exercises and problems on addition, comparison and subtraction with two-digit numbers, and on multiplication and division by 2 and 5.

Elementary class (7-9 years) : numeration up to 100, then to 1,000, coordinated with a study of the metric units in common use (without use of the decimal point) ; use and practice of addition and subtraction; multiplication tables; multiplication and division with numbers of not more than two digits, in simple everyday problems; mental arithmetic; areas of rectangles (sides in whole numbers); months, days, hours and minutes.

Middle class (9-11 years): decimals, coordinated with the theory and practice of metric units; use and practice of the four operations with decimals; everyday problems; divisibility by 2, 5, 3 and 9; the rule of three, simplification of a quotient; percentages and simple interest; fractions; measures of time and uniform movement; areas (rectangle, square, trapezium, triangle, polygon, circle); volumes (rectangular parallelepiped, prism, cylinder); measurement of angles.

Upper class (11-12 years): the same syllabus, but more developed; use of a table of the squares of numbers from 1 to 100 for finding two-digit square roots; volumes (cylinder, pyramid, cone); properties of inverse quotients.

Top class (12-14 years): application of what has been learnt to concrete everyday problems concerning the principal local occupations (agriculture, crafts, industry, commerce), and home, family and social life.

In all classes, concrete practical exercises take up three-quarters of the time, and, more especially in the preparatory and elementary class, form the basis of the theoretical work.

In all classes, too, in this case more especially in the top class, an endeavour is made to articulate mathematics with other subjects. Physical science offers frequent opportunities of measuring and reckoning. As much may be said of geography, with its areas, densities of population, manufactures, outputs, longitude and latitude, and distances travelled. Civics, too, calls for the use of arithmetic; its studies of budgets, taxes, social security and demography would otherwise be less precise.

Promotion is based on the results of examinations in which mathematics counts for as much as the mother tongue. These two subjects are the principal ones in such examinations.

In the primary school-leaving examination, a child's knowledge of arithmetic is assessed by a fifty-minute paper, and an oral test of five questions on mental arithmetic. Ten marks out of thirty-five in the written, and one out of six in the oral, are given for arithmetic.

AIMS

The teaching of arithmetic has different aims at different levels.

At the beginning of a child's schooling, it is most essential that he should first acquire the arithmetical skills, and learn to calculate quickly and accurately. The educational side of the subject is not neglected, but theory intervenes only as and when it is necessary as a proof of practice, and as a means of making practice more agreeable and fruitful for a child by giving him reasons for his activities.

In the middle and upper class, the skills having been acquired, teachers can give their attention to introducing elementary mathematical reasoning in a form adapted to their pupils' ages.

In the top class, with children who have not been selected for the secondary school and who are completing their last two years at school, before going out into life, teaching is directed to applying their knowledge to solving the everyday problems of the householder, farmer, worker or citizen, and is now more specialised, according to whether it is for boys or girls, villages or towns.

METHODS

A circular dated 7th December 1945 (published in the "Bulletin officiel de l'Education nationale" of 10th January 1946) gives precise details of the scope of the primary syllabus and how it should be applied in practice. It refers to the principles given in instructions issued as far back as 1923 : "Actual manipulation should always come before arithmetical manipulation, and everyday terms before mathematical ones... Facts form the necessary foundation for calculation and thought... "

Such principles are well described in the following passage from the instructions concerning the teaching of arithmetic in the preparatory class :—

"Numbers should first be learnt by observing, handling and drawing collections of simple and common objects. A child should be accustomed to recognising, without having to count, from one to five objects arranged first in simple domino groupings, then in straight lines, and then haphazard. He should study and learn the numbers from 5 to 10 by forming them with 5 and one of the first five numbers. He can then go on to study and learn the numbers from 10 to 20 by adding 10 to (uniting 10 with) one of the ten first numbers.

"Learning in this way is facilitated by the use of coins and the decimetre and double decimetre ruler, as indicated in the syllabus and as known to many children from their out-of-school activities.

"Numbers are not only obtained by counting columns, or composing them in the way indicated above, but also, even more often perhaps, by combining other numbers.

"Six, for example, is certainly the biggest group on a domino, but it is also one finger added to the fingers of one hand, or three pairs of shoes, or two lines of three, or 4 and 2.

"To have a true idea and grasp of a number, a child must be able to recognise its various aspects, and know its name, appearance and composition.

" Of what numbers should he know the make-up and composition in such a way ? Certainly of the first ten, and possibly the next ten. Beyond that, it becomes more a matter of calculation than of memory.

" Such a way of learning coincides with that of the addition table. Many acts of addition comprise, in fact, acts of composing and decomposing numbers.

" One interesting peculiarity of many such acts of addition is that they are in reality acts of subtraction or, more precisely, *acts of discovering the unknown part of a total whose other part is known* : how can 9 be made with two numbers of which one is 6 ? "

The instructions from which the above passage comes, indicate in similar fashion how all the other points in the primary arithmetic syllabus should be taught. It is worth emphasising that the metric system figures large in arithmetic, inasmuch as French measures all follow the rules of numeration with 10 as base. Most of the concrete numerical exercises that the children do, are taken from the metric system.

The use of geometry is equally important in regard to work with areas and volumes.

A great variety of teaching materials is used in the teaching of mathematics, especially in the early stages. The group ball-frame has been practically given up, but the individual ball-frame and counting sticks still have their supporters.

Official instructions recommend the use of coins, small 10-centimetre rulers, and chessboards with 100 squares, for teaching the principles of decimal numeration.

Boards are also used, with 100 holes for receiving wooden pegs, dominoes, cards of buttons, member boxes, and the like.

Teachers have shown no little ingenuity in this field, and many of them have invented very good materials and made them from odds and ends.

In the nursery-infant schools and the preparatory class of the primary schools, numerous educational games are used. The necessary materials are almost invariably thought of and made by the teachers, and take in consequence very varied forms. At the normal schools teachers-in-training are encouraged to think out such games, frequently with the most surprisingly successful results and inspiration deriving in many instances from lotto, dominoes, buying and selling, and so on.

Official instructions contain no recommendations whatsoever concerning the use of arithmetic textbooks or books of problems in primary schools. In practice, a textbook is used nearly always in the middle, upper and top classes, quite often in the elementary class, but only very rarely in the preparatory class.

All such textbooks are well illustrated, and give the essence of what a child should retain from a lesson. They also contain numerous graded exercises of which the teacher can take his choice.

The school authorities, be it repeated, neither impose nor so much as recommend books. Choice is made by the teachers themselves. All primary teachers in a given primary inspection area attend an annual conference at which they lengthen, or reduce, in very liberal fashion, the list of books authorised for school use. Each teacher then chooses from the list the textbook he elects to use in his class.

In schools with several classes, it is the teachers' committee which decides on the books to be used, in order to achieve articulation between the different classes, and a measure of unity of method.

In schools employing activity methods and individual teaching, textbooks are replaced by arithmetic cards (complete with " auto-correction " cards) and, when necessary, the use of books of reference.

MISCELLANEOUS

No modifications are at present contemplated in the texts concerning the teaching of mathematics in primary schools.

The last modifications made had a double object :—

a) " To restore to our primary teaching its pristine simplicity and efficiency in regard to the acquisition of the basic skills ".

b) " To ground it in larger measure on facts and individual observation, in order to give French youth the *grand bain du réalisme* —the touch of reality—of which it stands in need ".

Among French works on the teaching of mathematics in primary schools, the following are especially worthy of mention :— " Pour apprendre les nombres ", by CHATELET, Albert, CREPIN, E. and BLANQUET, L. (Paris, Bourrelier) ; " Pas à pas des faits à l'idée ", by GAL, Jules (Paris, Nathan) ; " L'initiation mathématique ", by LAISANT, Ch. (Paris, Hachette) ; " Initiation au Calcul ", by PIAGET, Jean, BOSCHER, Berthe and CHATELET, Albert (Paris, Cahiers de Pédagogie moderne).

HAITI

From the reply sent by the Directorate of National Education

PLACE OF MATHEMATICS IN THE CURRICULUM

The first notions of arithmetic may be given in Haiti in the infant class, in quite concrete fashion, but teaching that is in any way formal begins only in the first year of the preparatory section of the primary school.

The official curriculum sets aside two hours a week for the introduction to arithmetic in the preparatory section of the primary school, and two and three hours a week respectively for arithmetic in the elementary and intermediate sections. It is generally agreed, however, that these times are by no means enough, and in practice they are increased to half-an-hour a day (two-and-a-half hours a week) in the preparatory section, and to an hour a day (five hours a week) in the elementary and intermediate sections.

Notions of geometry first appear in the syllabus at the intermediate stage, and are given together with lessons on the metric system.

SYLLABUSES

The principal points of the arithmetic syllabus are as follows :—

Preparatory section: numeration and notation up to 100 ; easy addition, subtraction, multiplication and division with whole numbers and very occasionally decimals ; simple problems on addition, subtraction and multiplication.

Elementary section: decimal numeration ; the principal units of measure ; the four operations with numbers up to 1,000 ; problems.

Intermediate section: problems on the four operations ; compound rules ; the metric system ; calculating areas and volumes ; decimals ; fractions ; simple rule of three ; simple interest.

All lessons conclude with practical exercises done on the blackboard or in the children's exercise-books. As far as possible, problems are everyday ones arising in the environment.

Arithmetic is not taught absolutely independently of the other subjects in the curriculum. Teachers refer on occasion to science, physical education, reading, handwork, drawing, etc.

The most important subjects in the examinations are mathematics, French and the nation's history.

AIMS

The aim of teaching arithmetic in the primary school is to give a child certain modest notions of bookkeeping, and enable him to make out a bill and calculate quickly and accurately.

METHODS

Recommendations on method have been issued. Teachers are asked to make use first of feeling and intuition, children being expected to do work with objects and pictures before passing on to numbers. Similarly, teachers are urged to deal with arithmetical problems in a concrete way before giving written exercises on them.

The appeal to concrete things entails the use of teaching materials, which include ball-frames, beads, counting sticks, marbles, sweets and pictures.

The textbooks used are obtained from abroad, teachers adapting them to their needs ; the subject-matter of problems should as far as possible be suggested by, and concern, the children themselves.

HOLLAND

From the reply sent by the Ministry of Education, Arts and Science

PLACE OF MATHEMATICS IN THE CURRICULUM

Under the heading of *rekenonderwijs*, arithmetic is taught in Dutch primary schools from the 1st class onwards, for from four to six hours a week. At the nursery-infant school level, certain games are in effect a preparation for the subject.

Notions of geometry are included in the arithmetic syllabus.

SYLLABUSES

The principal points of the primary school syllabus are as follows :—

1st class: numeration up to 20 ; addition and subtraction ; in some cases, numeration up to 100.

2nd class: numeration up to 100 ; mental arithmetic ; metre, decimetre, centimetre ; multiplication tables.

3rd class: numeration up to 1,000 ; mental arithmetic ; measures of length ; litre and hectolitre, kilogram and hectogram ; year, month, day, hour, minute and second.

4th class: numeration of numbers beyond 1,000 ; simple fractions and decimals to three places ; revision of metric units done in the preceding class, and then square metres, decimetres and centimetres, decilitres, and cubic metres, decimetres and centimetres.

5th class: problems in application ; dividing fractions by whole numbers ; conversion of ordinary fractions into decimal fractions, and vice-versa ; hectares, ares and centiares ; cubes and polygons ; scale, percentage ; interest and proportional parts.

6th class: problems of economic activities ; graphs ; use of railway and other time-tables ; buying, selling, profit and loss ; gross weight, load, net weight.

At all levels, teachers endeavour to maintain a close connection between the arithmetic lessons and the problems of everyday life, and this entails the careful articulation of the various subjects in the curriculum. Arithmetical problems often arise in geography (length of a journey, distances, average speeds, balance of trade, international exchange), elementary science (agricultural problems) and history (calculating ages, increases in population, and the like).

School reports, generally given at the end of term, serve the purpose of yearly examinations in Holland, and special importance is attached to the mark a child gets for mathematics.

AIMS

There are no official instructions on the aims of teaching mathematics, but it may be said that in the Dutch primary school it aims mainly at helping children to master the quantitative relationships they will need to understand in their after-school life.

METHODS

The school authorities do not stipulate the use of any particular teaching method. The teaching materials in general use include the ball-frame, pictures, weights, decilitres, litres, cubes, cones, spheres, dice, dominoes, and objects which can be counted, weighed, measured and so on. Various games are also considered of great value as auxiliaries.

All the textbooks are products of individual enterprise. Those in use in the private schools are chosen by the headmaster. The list of those which may be used in the public schools is drawn up by local committees of teachers.

MISCELLANEOUS

The information given above applies only to the first six classes of the primary school. In addition to these there are school-leaving classes attached to the primary school, whose syllabus consists of a revision of the ground covered in the previous years, special emphasis being given to its pre-vocational (agricultural, commercial or industrial) aspects.

Of several recent works on the teaching of arithmetic, mention may be made of KOHNSTAMM's books on children's logical processes, and reading and arithmetic exercises ; and G. GRAZER's book on arithmetic and modern psychology.

Reference may also be made to the various reports (in particular Nos. 26, 31, 32, 33 and 35) published in the " Editions Wolters " by the teachers' study-group.

HUNGARY

From the reply sent by the Ministry of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

The primary school in Hungary consists of the first four of the eight classes of the " general-comprehensive " school. A subject called " arithmetic and measurement " is taught from the first primary class (children of six to seven years of age) onwards, and five hours a week are devoted to it in each class.

Geometry as such is not taught in these four primary classes, but notions of it are given in the course of lessons on " measurement ".

SYLLABUSES

The results to be obtained in each primary class are as follows :—

1st class : addition up to 20, then to 100.

2nd class : the four operations with numbers up to 100.

3rd class : the four operations with numbers up to 1,000, then to 1,000,000.

4th class : the four operations with whole and decimal numbers, and fractions.

From the 1st class onwards, numerous practical exercises are given mainly concerning measurement.

No attempt is made in principle to teach mathematical ideas incidentally during lessons on other subjects.

In Hungarian primary classes there are no yearly or school-leaving examinations.

AIMS

Introduction to mathematics in the primary classes is expected to enable a child to calculate quickly and accurately, to understand the basic mathematical relationships, and to apply his knowledge when necessary in everyday affairs concerning, for example, domestic economy, agriculture, industry and commerce. The subject is also regarded as a means of developing the ability to reason, to make sound judgments, and to think in abstract terms.

METHODS

In 1946 the Ministry of Education issued official recommendations on the teaching of mathematics, but they need revision, and new recommendations are to be published shortly.

An endeavour is made to have arithmetic taught in the light of the following principles : concrete presentation and exercises for learning and fixing knowledge ; group work ; integration ; logical reasoning.

New teaching materials are about to be introduced. At the present moment teachers use various pictures and instruments, but they are under no compulsion to do so.

Educational games are not in principle used.

Official textbooks, which all schools must use, are published for each class, and there are three different editions of each book, adapted to the interests of urban, village and country children respectively.

MISCELLANEOUS

The Hungarian educational system has been influenced by that of Soviet Russia, which rejects formal and mechanical teaching and replaces it with solving problems that are extremely varied in nature, purpose and type. Pupils are asked to set themselves problems, which they then have to analyse and solve.

In the last two years several articles have been published on the teaching of arithmetic, but no books.

ICELAND

From the reply sent by the Ministry of Education

Place of Mathematics in the Curriculum

Compulsory schooling in Iceland is from seven to twelve years of age. Children enter the primary school on the 1st of September falling in the year of their seventh birthday.

They are taught a subject called *Reikningur* (reckoning or arithmetic) from the 1st class onwards. In importance, *Reikningur* comes after the mother tongue, and thus takes second place. Four to six hours a week are devoted to it.

There is no special teaching of geometry at the primary school. Children have to learn to calculate the areas of simple figures, such as the ground plan of a house, or a field or garden.

Syllabuses

The main points of the syllabus are as follows :—

Seven-year-olds: numeration and notation ; addition and subtraction with numbers up to 20 ; mental arithmetic.

Eight-year-olds: addition, without carrying, of two or more two-digit numbers ; addition, with carrying, of a two-digit and a one-digit number ; subtraction without carrying of two-digit numbers ; multiplication without carrying of a two-digit number by a one-digit number ; multiplication tables up to 6 ; division by 2 and 5 ; mental arithmetic.

Nine-year-olds: addition, subtraction and multiplication with carrying of three-digit numbers (one-digit multipliers) ; multiplication tables ; division of numbers with up to three digits (one-digit divisors) ; half, third and quarter of some numbers and concrete quantities ; mental arithmetic.

Ten-year-olds: revision ; exercises with the four operations (two-digit multipliers and one-digit divisors) ; multiplication tables ; notions of geometry ; mental arithmetic.

Eleven-year-olds: revision; the four operations with decimals; addition and subtraction with fractions with the same denominator; multiplication and division of a fraction by a number; notions of geometry; mental arithmetic.

Twelve-year-olds: revision work and exercises; the four operations with fractions and simplification; multiplication and division by 10 and 100; notions of geometry; metric system; mental arithmetic.

Notions of mathematics may also be given incidentally during geography, natural science and other lessons.

In examinations, mathematics and the mother tongue are the deciding factors.

AIMS

With the aid of what they learn in mathematics at the primary school, pupils should be able to solve relevant problems arising in the course of their everyday work, and to go on to a school at secondary level.

METHODS

There are no official recommendations on the teaching of arithmetic in primary schools, but help is given in this connection at the normal schools, and by inspectors during school visits. To a very large extent, teaching is based on observation. The most frequently used aids are the ball-frame and the tape-measure.

The government school publishing department provides arithmetic textbooks, but their use is in no way compulsory. Teachers and inspectors have a large measure of freedom in this respect.

MISCELLANEOUS

The educational journal *Menntamal* has published various articles on the teaching of mathematics. Reference may also be made to "Drög ad námsskrám fyrir barnaskóla og gagnfraedaskóla" (the primary and upper primary school curricula).

INDIA

From the replies sent by the Chief Commissioner of Kutch and the Directors of Public Instruction of Bihar and Mysore, and forwarded by the Central Bureau of the Ministry of Education

Kutch

PLACE OF MATHEMATICS IN THE CURRICULUM

The study of mathematic begins with arithmetic in standard I at the age of six. Five periods are devoted to it up to standard III and six from standard IV to VII.

Such lessons include elementary work in geometry from standard IV onwards.

SYLLABUSES

The syllabuses adopted are those prescribed by the Bombay Government.

The matters dealt with under the headings of arithmetic and rudiments of mathematics are briefly the following :—

Standard I : counting up to 100 ; tables 10×10 ; simple additions and subtractions ; understanding of plus and minus signs and knowledge of units and tens.

Standard II : measurements ; telling the time ; cutting paper into fractions; knowledge of Indian coins ; counting up to 1,000; tables up to 12×16 and 16×10 ; simple multiplications and divisions ; knowledge of simple tables and fractions.

Standard III : simple weighing and measuring ; study of simple tables of coins, etc. ; writing up to 10,000 ; higher multiplications and divisions ; knowledge of simple fractions both in figures and lines.

Standard IV : simple accounts of stores at home and school ; knowledge of buying and selling and simple transactions at the post office ; reading and writing up to 1 crore (ten millions) ; simple fractions, their addition, subtraction, multiplication and division ; simple proportion, simple household accounts, simple interest and divisions of amounts of money or weights by a sum not exceeding 20.

Standard V: work with time and speed ; measurements of fields, etc. ; simple methods of multiplication and division ; further work with fractions ; approximation, simple and compound proportion, simple interest, profit and loss ; decimals (simple additions and subtractions) ; measurement by a metre ; simple mensuration ; measurement and construction of angles, drawing of square and right-angled figures to measurement ; simple accounting for daily household transactions.

Standard VI: decimal fractions ; compound interest ; savings accounts ; simple practice ; profit and loss ; simple mental exercises ; weekly and monthly accounts ; construction of angles, bissection of straight lines, drawing of perpendiculars and plans of journeys, etc.

Standard VII: drawing of plans of fields by triangles ; measurements of fields and circular plots ; measurement of solids ; simple oral exercises in time work and speed ; properties of parallel straight lines and construction of angles according to given angles ; substitution of letters in place of figures as a preliminary to algebra.

At every level, great importance is given to practical work.

An attempt should be made to introduce children to mathematics incidentally, in connection with other subjects, but this is seldom done because of the lack of skilled teachers trained in such work.

In the examinations, mathematics are treated as a major subject.

AIMS

Instructions are given to connect the teaching with life.

METHODS

Teaching methods are demonstrated by practical lessons at the training school. Inspectors also demonstrate them at the time of their visits to the schools.

The principal aids to teaching are beads, weights, measures and coins.

Activities based on games are not much in vogue though efforts are made by some enthusiastic teachers to organise school shops for purchases, measurements, etc.

Books are prescribed by the Text Book Committee. They are generally selected from the books sanctioned by the Bombay Education Department.

MISCELLANEOUS

The new syllabus prepared by the Bombay Government is adopted in big schools where the staff consists of trained teachers. It is being explained in other schools and will shortly be adopted in all schools.

In the new syllabus, less attention is paid to the arithmetic tables, which were formerly crammed and a regular drilling given in them every day at home and in school. This was very helpful in after life. At present cramming is discouraged and scientific study is encouraged. It is felt that all the tables and short cuts to mental arithmatic should be given proper place. This may be done after the proper understanding of the general principles.

Bihar

PLACE OF MATHEMATICS IN THE CURRICULUM

The study of the rudiments of mathematics begins at the age of six in the infant class.

Five weekly periods (two and a half hours) in the infant class and class I, eight periods (four hours) in classes II and III, and five periods (three hours) in classes IV, V, VI and VII are devoted to this subject.

Practical geometry is introduced in class IV, and theoretical in class V.

SYLLABUSES

Under the headings of arithmetic and rudiments of mathematics the following matters are dealt with :—

Infant Class and Class I: simple counting and fundamental rules (oral and practical) ; games.

Classes II and III: compound rules and " shubhankari ".

Classes IV and *V:* practical geometry and household accounts in connection with the craft and field work.

Classes VI and VII: Book-keeping and elementary ideas of theoretical geometry.

In all classes, attempts are made to link problems in arithmetic with the lives and needs of the children, who thus learn a great deal of book-keeping, household accounts and practical geometry in connection with gardening, shopping, craft and field work.

Mathematics are a compulsory subject of study and every child is required to attain a certain standard of proficiency in it to enable him to proceed to a higher class.

METHODS

The Hand-book of Suggestions or the Teachers' Manual are approved by the Department for the use of teachers.

Concrete materials, work books, speed cards and materials for games are the principle aids to teaching. The books are revised and prescribed for different zones by the Text-book Committee.

Mysore

PLACE OF MATHEMATICS IN THE CURRICULUM

The teaching of arithmetic begins at the age of five plus in class I of Mysore's primary schools. Six periods a week (one period of about forty-five minutes a day) are devoted to the subject in each of the four classes.

As the primary stage of education ends at the age of nine plus, geometry is not taught as a subject either separately or combined with arithmetic in primary schools.

SYLLABUSES

The matters taught as arithmetic or rudiments of mathematics in primary schools are in brief :—

Class I: numeration and notation up to twenty ; addition of numbers of one digit, total being not more than twenty ; multiplication, totals up to 3×10, to be taught by the use of examples from everyday life.

Class II: numeration and notation up to 100 ; subtraction of numbers within 50 ; multiplication tables up to 5×10 ; multiplication of numbers whose product does not exceed 50.

Class III: numeration and notation up to 100 ; multiplication tables up to 10×10 ; simple divisions ; practical measurement of length in inches, tables of length involving inches, feet and yards ; simple problems, involving addition, subtraction, multiplication and division, from everyday life.

Class IV: numeration of numbers up to 1,000; multiplication tables up to 16 × 10; measurement of the school garden; tables of length, tables of money; rule of three; simple fractions, addition and subtraction of simple fractions, common denominators; prime factors, L.C.M. and H.C.F. of simple numbers; problems involving tables of length, weight and money.

It is to be noted that all the items in the rudiments of mathematics are taught through practical work only and the correlation of teaching of mathematics with other subjects is attempted. For example, in gardening, the plots are measured and lengths and areas are calculated.

At the yearly and school leaving examination a pass in arithmetic is insisted upon, the minimum being 25%.

AIMS

At the nursery school stage, the aim is to introduce ideas about numbers to children.

At the primary stage, the idea is to teach the fundamental operations of arithmetic.

METHODS

The official suggestions, as mentioned above, are that the rudiments of mathematics be taught through practical work and actual measurement. Beads, seeds, sticks, etc. are used as teaching aids.

At the nursery school stage, at the age of four or five years, mathematics are introduced through educational games.

Textbooks in arithmetic are prepared and provided for schools. They are used at the age of seven plus. They include practical and theoretical examples.

MISCELLANEOUS

The present arrangement was brought into force five or six years ago. Methods of teaching mathematics through activity related to life as used in Basic Education are being considered.

IRELAND

From the reply sent by the Department of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Arithmetic is taught to the pupils of primary schools from the time they are admitted as " Junior Infants ". In infant classes, the subject is called " number ", and in higher classes " mathematics ". This latter term denotes for standards I-IV arithmetic only, for standards V-VIII (ages 11-14, approximately) arithmetic, algebra and geometry.

Geometry is a separate subject, optional in one-teacher, two-teacher and three-teacher schools and in all classes taught by women. In three-teacher boys' schools either geometry or algebra must be taught to pupils in standards V-VIII.

The time devoted to mathematics is approximately three hours per week in infant classes (pupils up to the age of about seven years) and four hours per week in standards I-VIII (pupils 7-14 years).

Periods are usually of half an hour.

SYLLABUSES

The outline of mathematics contained in the curriculum includes :—

Junior infants class: counting up to 20 by means of objects ; recognition of number groups up to 10, and associating figure with group ; simple addition of small numbers, using objects (totals need not exceed 10).

Senior infants class: addition of numbers, using concrete material (totals need not exceed 20) ; addition tables to be built up gradually as the children's grasp of number develops ; simple concrete exercises in subtraction ; easy shopping problems with pence and halfpence (totals need not exceed a shilling) ; counting in twos, threes, fours, etc., using objects ; counting in tens up to 100 as a basis for notation.

Standard I: numeration and notation of numbers of two digits ; addition and subtraction tables ; multiplication tables up to 6×6, and inverse processes; addition and subtraction (the number of addends not to exceed three, the results not to exceed 99); easy applications of the above operations, involving a knowledge of the sub-divisions of a shilling.

Standard II: numeration and notation of numbers of three digits; multiplication tables up to 12×12 and inverse processes; addition and subtraction (the number of addends not to exceed 5, results need not exceed 999); multiplication by numbers up to 12; the idea of one-half, one-third, one-quarter, using concrete examples; easy applications of the above operations, involving a knowledge of the sub-divisions of the pound sterling.

Standard III: numeration and notation of numbers up to 10,000; multiplication tables and mental exercises on division arising out of them; division by numbers up to 12; a knowledge of the meaning of one-half, one-third, etc., up to one-twelfth, with applications to concrete examples; extension of simple operations to larger numbers (multipliers may be limited to numbers of two digits and divisors to numbers not exceeding 12); addition, subtraction, multiplication and division applied to small sums of money.

Standard IV: numeration and notation of whole numbers; extension of knowledge of fractions already acquired to include cases where the numerator is greater than one (the denominator need not exceed 12); exercises in practical measurement; measurement of lines to nearest tenth of an inch; decimal notation for tenths; the simple operations, including long division applied to whole numbers, to numbers containing one place of decimals and to sums of money (multipliers and divisors in questions on money or decimals not to be greater than 12); multiplication and division by factors, not applied to money questions; easy questions involving knowledge of money tables and of the more common units of weight, length and capacity, not more than two denominations being used in any question; easy shop bills; easy applications of the above; very simple applications of the unitary method confined to whole numbers; the use of a symbol to represent an undetermined quantity as an introduction to formal algebra, which begins in standard V.

Standard V: Arithmetic: numeration and notation of whole numbers and decimals to three places; development of idea of fractions, practical illustrations, equality of fractions, easy addition and subtraction of fractions; a knowledge of such units of money, weight, length, capacity and time as are in common use; the calendar; square measure, and simple exercises on rectangular areas; elementary operations (including application of the unitary method) with the above-mentioned units and with decimals to three places; shop bills; a knowledge of the meaning of percentage, simple applications involving the use of 5, 10, 20 and 50 per cent; easy applications involving the above ; in classes taught by men teachers, where the nature of the work permits, the pupils should be trained to generalise the reasoning, by employing a symbol to represent any whole number.

Algebra : more special study of the meaning and use of arithmetical symbols ; use of a symbol in solving easy problems leading to simple equations ; addition, subtraction, multiplication and division of quantities consisting of a single term ; the application of these processes to the simpler operations occurring in the arithmetical course, excluding questions involving the use of decimals and all but the simplest exercises in the unitary method and fractions.

Geometry (in this and the following standards no formal proof will be required, but pupils should be able to support statements by common sense reasons) : elementary practical constructions, such as bisection of lines and angles and drawing of perpendiculars (these may be done in the first place by paper-folding, or use of tracing paper or set-squares, and, later on, by means of ruler and compass) ; construction of triangles with ruler and compass, use of protractor and explanation of its construction ; simple construction of loci, path of a point which moves so as to remain at a constant distance from a fixed point, path of a point which moves so as to remain at a constant distance from a fixed line, path of a point which moves so as to be always at equal distances from two given lines, path of a point which moves so as to be always at equal distances from two given points.

Standard VI: Arithmetic: operations with simple and compound quantities, including decimals and vulgar fractions ; the metric system ; the use of the ready reckoner ; further development of the unitary method and of percentage leading to notion of ratio, expression of decimal and vulgar fractions as percentages, and vice-versa ; solutions of problems depending on ratio and percentage, including simple interest and commercial discount ; the principle and use of aliquot parts ; averages (throughout the work, pupils should be trained to check their results by rough approximations) ; further easy exercises on the rectangle and on the area of triangles, including the area of fields, regular and irregular, use of the chain (may be omitted in classes taught by women-teachers) ; where the nature of the work permits, the pupils should be trained to generalise the reasoning, employ a symbol to represent any number, and perform with the symbol such operations as they perform with particular numbers, so as to lead up to and include the use of formulae (may be omitted in classes taught by women-teachers).

Algebra : further practice in the meaning and use of symbols, operations with algebraic expressions containing two or three terms, with the reasons for same and with due reference to the corresponding arithmetical operations ; simple problems and equations of the first degree, distinction between identical and conditional equations, simple factors, verification of algebraic results by numerical substitution; meaning and use of positive and negative numbers and operations with these.

Geometry: an idea of symmetry and axes of symmetry; symmetrical figures, such as circle, square, rectangle, and equilateral and isoceles triangles; further easy constructions of loci (approximately half a dozen), problems depending on same; conditions for congruence or identity of triangles (without formal proof), simple exercises depending upon the congruence of triangles, including the proof of the validity of the practical constructions already made; properties of parallel lines; notions of shape as distinct from size, properties of similar figures (derived from study of pictures, plans, models or maps); easy study of angles, triangles, rectangles and circles.

Standards VII and VIII: as in standard VI but of a more advanced type. Managers and teachers are at liberty to submit, for approval through the inspectors, alternative programmes for these standards.

In all standards, the importance of practical work is strongly emphasised. The official programme prescribes that in the selection of matter for questions the teacher should have regard to the experience and interests of the pupils and that, whenever possible, the pupils should obtain the data for the questions, e.g. by counting or measuring objects.

The work in mathematics should be correlated as far as possible with the work in other subjects: in geography, the cardinal points, the drawing of plans; in physical training, the right angle as a measure of rotation; in domestic economy, measurement of needlework materials, keeping of simple household accounts; in language lessons, topics related to shopping, weighing, measuring and the like, in both Irish and English.

Arithmetic is an obligatory subject at the Primary Certificate Examination, which is taken by all pupils in National Schools on completion of the standard VI course, at the age of 12-13 years.

AIMS

In the foreword of a booklet entitled "Notes for Teachers—Mathematics", published by the Department of Education, it is said:—

"To teach these branches successfully it is necessary to have some clear conception of the end at which we are aiming. A certain amount of arithmetical knowledge is necessary for everybody in the ordinary affairs of life, but a little reflection will show that it is small, and that the conveying of this amount of knowledge is not the main purpose of teaching even arithmetic in the schools. We proceed beyond the mere essentials because of the training which the subject affords our pupils, training 'in the art of thinking—consecutively, closely, logically', and also because of its application to the social life of the pupils.

" We have to secure that the pupils are quick and accurate at simple calculations, which implies that they must have a thorough knowledge of the tables and abundant practice at using them in the simpler operations of arithmetic; that they study and understand principles so as to be able to apply them to the problems of life, and at the same time to secure for themselves the maximum benefit in the way of clear thinking and preciseness and readiness of thought and expression. "

METHODS

Official suggestions concerning the teaching of mathematics are laid down in the Programme of Primary Instruction and in the Notes for Teachers. They insist on the fact that according to the end aimed at it is the investigation or examination of principles, not the working of " Rules ", that has to be undertaken. A sufficient number of simple concrete examples can thus be so presented that the underlying principle is readily grasped and then set out in a general statement. It is not suggested that every item must be grasped by every pupil before advancing; the progress in the class whose teacher insisted on this would be slow.

Furthermore, it is said that in arithmetic and algebra, mental work should precede and lead up to the written work; throughout the course, due attention should be paid to the development of speed and accuracy; the use of the symbols +, —, ×, ÷, =, from an early stage, is recommended; as far as possible the pupils should be led to discover principles and methods by themselves. In geometry, the intention is that the pupils shall be engaged in exploring and investigating the facts for themselves, and shall later on arrange and classify the results of their work, and build up suitable definitions.

The teaching aids chiefly used are blackboards, charts and illustrations, instruments for drawing and measuring, counters, number-cards, make-believe shops, coins, etc.

Mathematics are introduced through educational games in the infant classes (age group 5-7).

The use of textbooks is not officially prescribed but it is presumed. They are submitted by publishers to the Department for scrutiny by the Department's Book Committee. An official list of approved books is published annually by the Department and only books so approved may ordinarily be used.

MISCELLANEOUS

On the teaching of mathematics in primary schools, the Department of Education has published " Notes for Teachers—Mathematics ".

ITALY

From the reply sent by the Ministry of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

In Italian nursery-infant schools, children of four to six years of age acquire their first broad notions of quantity and size. They begin to learn a subject called *aritmetica e geometria* (arithmetic and geometry) in the 1st class of the elementary school, at the age of six or seven years. Although time-tables are arranged by the teachers themselves, it can be said that in general one thirty-minute lesson a day is devoted to the subject.

At elementary school level, arithmetic and geometry are not, properly speaking, separate and distinct subjects.

SYLLABUSES

The arithmetic and geometry syllabus, a very carefully graded one, is in outline as follows :—

1st class: general knowledge and notation of numbers up to 20 ; counting upwards and downwards ; mental arithmetic ; synthesis and analysis of numbers ; graded exercises ; general concept of a dozen and writing of numbers in columns ; practical exercises on the four operations with numbers up to 20 (addition and subtraction without remainder) ; notions of geometrical forms, acquired by observing objects, and drawing them ; counting games.

2nd class: numeration and notation up to 100; writing numbers in columns ; counting upwards and downwards orally and in writing (in two's, three's, four's, and so on) ; mental arithmetic with idea of double, treble, quadruple, half, third, quarter, etc. ; relationships between units, tens and hundreds ; making and learning the Pythagorean table ; mental arithmetic with numbers up to 50 ; the four operations with remainder (one-digit multipliers and divisors) ; oral and written problems using only one operation ; notions of the principal plane-figures (square, rectangle, triangle, circle) and commonest solids (cube, cylinder, sphere) ; counting games.

3rd class: numeration and notation up to 1,000; synthesis and analysis of numbers; Pythagorean table; easy mental arithmetic with fractional quantities; whole numbers and decimals to three places; multiplication and division by 10 and 100; operations with whole numbers and decimals (two-digit multipliers and one-digit divisors); expenses, receipts, profit and loss, and their relationships; practical problems, orally and in writing, with not more than two operations; the metric system and its units of measure, multiples and sub-multiples; currencies; use of measures and application to everyday problems; Roman notation up to 12; recognising and drawing plane figures and solids, nomenclature, calculating perimeter of squares and rectangles; arithmetical games designed to facilitate reckoning and solving problems.

4th class: numeration up to 100,000; exercises on the notation, synthesis and analysis of numbers; speed exercises in mental arithmetic; operations, orally and in writing, with whole numbers and decimals (two-digit divisors); ordinary and decimal fractions, and practical exercises; the metric system, agrarian measures, notions of equivalents, practical problems; regular polygons and their areas; geometrical solids; geometrical drawing and construction of objects in common use; Roman notation up to 100; transcribing Roman figures into Arabic ones, and vice-versa; gross and net weight, loads, etc.; oral and written problems with not more than three operations; current prices, time-tables, tariffs, etc.; exercises in elementary bookkeeping (accounts for a school cooperative, small library, class newspaper, and so on); arithmetical and geometrical games and puzzles.

5th class: numeration up to 1,000,000 and beyond; mental and written arithmetic with whole numbers and decimals; exercises on changing ordinary fractions into decimal ones, and vice-versa; the use of the four operations in practical, simple cases; oral and written transcription of Arabic figures into Roman ones, and vice-versa; use of Roman numbers above 1,000; revision of the metric system with special attention to measures of volume and capacity; regular polyhedrons and their surface-area and volume; drawing and handwork in connection with the study of geometrical solids; broad and practical notions of ratio and proportion, and direct and inverse proportion; capital, interest, discount, unitary method; practical problems, orally and in writing; exercises on accountancy and bookkeeping; arithmetical and geometrical games and puzzles.

In mathematics lessons at all levels, practical exercises come first in importance, and the curriculum allows for opportunities to apply mathematical knowledge in lessons on the other subjects.

The results of the yearly and school-leaving examinations are based on mathematics and the mother tongue.

AIMS

The main object of teaching mathematics in the elementary school is to give a child a practical training for everyday life ; the value of the subject as a mental discipline is not, however, overlooked.

METHODS

The official arithmetic and geometry syllabus includes recommendations as to the methods of teaching the subject in a broad and practical way. Teachers are especially advised to adopt activity methods, subject-matter then no longer appearing to a child as an imposition from above, but as a discovery one has made oneself.

Teaching materials for the concrete aspects and support of the subject, are not specially made ones, but consist of things easily got together, such as pictures, tables, and collections of objects.

Teachers may use textbooks that deal with the various items in the syllabus in a way adapted to their pupils' understanding, and that contain a certain number of exercises.

MISCELLANEOUS

Given the present level of prices, it is generally held that the limits set for counting and for the four operations are too low. It has been observed that children of six to eight years of age can already acquire notions of a hundred and a thousand.

The teaching of mathematics is now being studied by a number of Italian research-workers. As far as books are concerned, besides LOMBARDO-RADICE's classic " Lezioni di didattica ", mention should be made of FERRETTI's " Il numero e i fanciulli ".

KOREA

From the reply sent by the Ministry of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

A subject called *sembon* (arithmetic) is given from the first grade of the primary school (six years of age) onwards. Four hours a week in the first and second grades and five hours thereafter are devoted to it.

Geometry is referred to in the arithmetic lessons.

SYLLABUSES

The main points of the arithmetic syllabus are as follows ;—

1st grade: numeration and notation up to 100 ; relation between ordinal and cardinal numbers ; easy additions and subtractions and the mutual connections ; forms and arrangements ; basic knowledge of number and quantity by counting months, days, hours or money.

2nd grade: addition and subtraction of two-digit numbers ; multiplication and division ; measuring of length and width ; making of lists ; numeration and notation up to 1,000.

3rd grade: division, practice in measuring length in detail ; the meaning of angles ; meaning of fractions, easy addition and subtraction of them ; the meaning of solid and weight ; width of plane figures ; numeration, notation, addition and subtraction up to 10,000.

4th grade: the meaning of decimal fractions and the decimal point, addition and subtraction of them ; connection between fraction and decimal fraction ; addition and subtraction by using the abacus ; numerical exercises on addition, subtraction, multiplication and division (multiplication between three-digit and two-digit numbers, division of four-digit by two-digit numbers) ; easy multiplications and divisions of fractions by whole numbers ; practice in measuring length and depth ; numbers up to 100,000.

5th grade: multiplication of decimal fractions and the general addition, subtraction, multiplication and division of fractions ; the numbers greater than 100,000 ; additions and subtractions of four- or five-digit numbers ; multiplication and division by using the abacus ; the meaning of solid and equality, and of functions ; reading and writing the proportional expression ; mensuration of areas and volumes ; basic properties of symmetrical forms.

6th grade: direct and inverse proportion ; the four rules as applied to fractions ; percentage and ratio ; basic properties of similar figures and spheres ; basic meaning of dynamics and movement ; the counting of fares of all kinds ; the calendar ; easy equations of the first degree ; applying the basic properties of simple machines.

At all levels, the aims of practical work are to enable children to solve questions by themselves, to select what they are individually interested in, to develop their thinking ability and intuition, to help them understand the mutual connections of the four rules, and those between integral numbers and fractions or decimal fractions, to train their memory, and to give them practice in experimentation and measuring.

Teaching materials for other subjects, seasons, regular events and current affairs are used for introducing children to mathematics. Before and after national anniversaries, their birthdays and special events, dates and the calendar are to be taught. Children are to be taught how to understand and draw graphs and diagrams in social studies lessons.

Mathematics is the most important subject for promotion in the yearly examination. A child whose mathematics results are excellent, is selected for the secondary school.

AIMS

The official summary of the aims of teaching arithmetic in the primary schools is as follows :—

To give children the understanding of number, quality and form necessary for daily life ;

To develop children's ability to think and deal with life mathematically.

METHODS

To attain the aims mentioned in the previous paragraph, teachers should concentrate on the numbers and quantities of daily life, so as to develop children's ability to a) think analytically and logically, and at the same time understand wholly and intuitively, b) discover and create through experiments, measurements and investigations, and

c) apply their knowledge to reality. Numerous exercises should also be given.

Ball-frames, arithmetic sets, wall maps and notebooks are used.

The official instructions require the use of textbooks. Textbooks for each grade are edited and published by the Ministry of Education. Reference books and printed exercises which children may use, if they like, must be approved by the Ministry of Education.

MISCELLANEOUS

No modifications have been introduced recently, but some are contemplated for the near future.

LEBANON

From the reply sent by the Ministry of National Education

PLACE OF MATHEMATICS IN THE CURRICULUM

A child's introduction to mathematics begins in Lebanon at the age of three, in the nursery school.

Five hours a week are devoted to arithmetic in each class of the primary school. Elementary, practical notions of geometry are taught in the framework of arithmetic in the 5th and 6th classes.

SYLLABUSES

The main points in the primary arithmetic syllabus are as follows :—

1st class : numeration up to 100 ; addition and subtraction with concrete one- and two-digit numbers ; addition tables ; multiplication and division by 2, 3, 4 and 5 ; simple exercises orally and in writing.

2nd class : numeration up to 10,000 ; the four operations (multiplication by two-digit numbers, division by 6, 7, 8 and 9) ; simple exercises and problems taken from everyday life.

3rd class : the metric system (metre, gram and litre, and their multiples) ; multiplication tables ; the simple rule of three ; problems with the four operations.

4th class : whole and decimal numbers ; the metric system ; compound numbers ; fractions ; direct and inverse rule of three ; percentage ; divisibility by 2, 3, 5 and 9 ; mental arithmetic ; problems ; notions of geometry ; drawing or construction of figures (lines, angles, parallels, perpendiculars, circumference, cubes, upright prisms).

5th class : prime numbers ; H.C.F. and L.C.M. ; squares and square roots ; density, uniform movement ; proportional parts ; area of triangles, quadrilaterals and circles ; volume of cubes, rectangular parallelepipeds, pyramids, cylinders, cones and spheres.

At primary level, arithmetic lessons have a definitely practical character (weighing, measuring, handwork, everyday problems).

Observation, drawing and handwork afford frequent opportunity of doing exercises.

In the yearly and final examinations, arithmetic takes second place only to languages.

AIMS

Arithmetic lessons have a utilitarian and an educational aim. On the one hand they should give children the practical knowledge they will need in life, and on the other develop their powers of reflecting, reasoning and willing.

METHODS

There are no official recommendations as to how arithmetic may best be taught. Teachers as a rule make use of inductive and deductive procedures, through presentation and questioning.

The teaching materials used comprise counting sticks, shells, seeds, counters, dominoes, beads and ball-frames at nursery school level, and scales and weights, various measures of length and capacity, wood or cardboard geometrical figures, and coins and notes at primary level.

LUXEMBURG

From the reply sent by the Ministry of National Education

Place of Mathematics in the Curriculum

Arithmetic is taught in Luxemburg from the beginning of compulsory schooling, with children, in other words, who are six years of age or over. Four to six hours a week, according to the level of the class and type of school, is devoted to the subject.

Geometry becomes a separate subject from the 6th class (children of eleven years of age) onwards.

Syllabuses

The chief points in the syllabus are as follows :—

1st class: numeration up to 20 ; addition, subtraction and their various combinations within the range ; exercises preparing the way for multiplication.

2nd class: numeration up to 100 ; synthesis and analysis of two-digit numbers ; addition and subtraction without remainder ; multiplication by numbers up to 5, within the range 1-50; use of weights and measures in common use (franc, metre, litre, pound, kilogram, dozen).

3rd class: addition and subtraction with numbers up to 1,000 ; multiplication and division with numbers up to 100 ; further work on measures.

4th class: the four operations with numbers up to 100,000 ; Roman notation up to 12 ; money and weights and measures ; introduction to decimals.

5th class: the four operations with whole numbers and decimals up to 1,000,000 ; the metric system ; notions of angles.

6th class: the four operations with whole numbers and decimals ; measures of area, and agrarian measures ; calculating the area of rectangles, squares, trapezia and triangles ; measures of volume and capacity ; volume of cubes and prisms ; fractions, simple rule of three.

7th class: revision of work taken the previous year; the circle; volume of cylinders, cones and pyramids; direct and inverse rule of three; percentages and interest; profit and loss.

8th class: calculating areas and volumes; percentages; discount; simple and compound interest; insurance; accounts.

Teachers should choose exercises allowing them in arithmetic lessons to touch on problems either connected with other subjects in the curriculum or of quite obvious practical value.

German and arithmetic are the principal subjects studied in the first two primary classes, and French, German and arithmetic in later classes. Children who do not obtain a satisfactory average of marks in class for the principal subjects may have to stay down for another year.

AIMS

The teaching of arithmetic should give a child the knowledge he will need in practical life, and aid in developing his intellectual powers.

METHODS

The primary curriculum includes instructions as to how arithmetic should be taught. They lay emphasis on the necessity of beginning with direct observation or the handling of concrete objects. Setting pupils to solve concrete problems should be one of the teacher's chief concerns, the power of thinking in abstract terms and mechanical skills being acquired only gradually.

As regards teaching materials, it is to be noted that ball-frames have practically fallen out of use. Official instructions recommend more the use of dice, fruits and counting sticks. Coins and notes are also commonly used.

Textbooks are in general use. They are ones written by primary teachers of long standing, and must have been approved by a special committee.

MISCELLANEOUS

The present curricula came into force at the beginning of 1947. They impel the whole school system towards activity methods.

NEW ZEALAND

From the reply sent by the Ministry of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

The study of mathematics begins with number in the infant room, and a child is introduced to it on his admission at approximately five years of age. In his first two years (the " primer " classes) the aim is to give him a conception of numbers up to 20, to arouse an interest in the subject by attractive and instructive games and apparatus, and to enable him to build up a knowledge of number combinations by practical experiences.

In the following four classes (the " standards ") the instruction is called arithmetic.

Approximately one period per day is devoted to the subject. In the " primers ", this does not exceed half-an-hour, and may be subdivided into two quarter-hour lessons. In the four " standards ", the time allotted varies, as teachers are allowed considerable latitude, but the general range is between three and four hours per week.

Geometry is not a separate subject. It plays very little part in the primary school curriculum, but is introduced, in a very practical way only, in the arithmetic syllabus for the eighth class (" Form II ") at approximately twelve-thirteen years of age.

SYLLABUSES

In the " primer " classes the number facts up to 20 are discovered.

In " Standard I " the children have more actual drill in tables and are taught numbers up to 100. They are made familiar with the four processes of addition, subtraction, multiplication and division. They are introduced to a) the common coins (pence, threepence, sixpence, shilling, florin and half-crown); b) measures of length (yards, feet and inches); and c) measures of capacity (pints and quarts). They are also taught halves and quarters.

In " Standard II " the knowledge of numbers is extended to 1,000, and the same measures are used, with increasing difficulty. Shopping is introduced, with the addition of relatively simple items and the giving of change. The $^{1}/_{2}$ pint, $^{1}/_{4}$ pint, $^{1}/_{2}$ lb. and $^{1}/_{4}$ lb. are brought in, and also the $^{1}/_{3}$ fraction.

In " *Standard III* " the knowledge of numbers is extended to 10,000, and money sums involving addition, subtraction, multiplication, division and reduction are used to a much greater extent. New fractions include the sixths and eighths. Time is introduced, involving the use of the calendar and a knowledge of the week, day, hours and minutes. Measures of weight are extended to include tons, cwts and quarters.

In " *Standard IV* " numbers are extended to 100,000. Long multiplication and long division are introduced. Roman numerals are also used. Distance is extended to include the mile, furlong and chain, and weight to include the stone. Area is introduced, involving the square yard, square foot and square inch, the drawing of simple plans and the finding of perimeters. Dry measure involving the bushel and peck is also introduced. The reading and understanding of tables, such as railway time-tables, postage rates, etc., is also stressed.

In " *Form I* " mixed numbers and improper fractions are introduced, the four rules as applied to fractions, and the expression of one quantity as the fraction of another. Other new introductions are decimals (all rules), percentages, proportion, averages and discounts. Area is extended to cover the acre and square chain. Scale drawing is also taught.

In " *Form II* " (the final year of the primary school) the decimal system is extended to three places of decimals and includes conversion from decimals to fractions and vice versa, and multiplication and division of decimals by decimals. The metric system is introduced for length, weight and capacity. Other features are simple interest, rates and taxes and study of balance sheets, measure of cubic capacity and papering of rooms. Practical geometry is introduced, and a knowledge of triangles, circles and angles. Graphs are also used.

Great importance is attached to practical work. Indeed, it is stressed that practical work must precede written work, and every effort is made to relate all problems to the practical things in life.

No attempt is made to introduce mathematics into other subjects, except perhaps in woodwork, where the children may be taught problems in connection with angles.

Arithmetic is one of the subjects tested by headmasters in determining if a pupil is entitled to his Primary School Certificate. It has no special significance and the marks in this subject are considered along with marks in other subjects.

AIMS

The arithmetic syllabus stresses the need for relevance both to the interests and experience of children as children and to their future requirements as homemakers, workers and citizens. This implies a programme with social, practical and aesthetic content not for the purpose of embellishing mechanical operations, but in order to give children an understanding of the need for the mastery of the various processes and an appreciation of their wide range of application in everyday life.

METHODS

The following suggestions as to methods are made in " Revised Syllabuses " :—

a) *Uniformity of Method in Mechanical Operations.* In New Zealand where there is a great deal of transfer of pupils from school to school there is a particularly good case for uniformity of method in certain mechanical operations. Variety of method often leads to confusion and waste of time and effort. The methods proposed are :—

(i) subtraction by complementary addition with adjustment by the method of equal additions ;

(ii) multiplication from right to left (the method at present generally used in primary schools) ; and

(iii) division : quotient to be placed on top in all types of division, except in certain operations in conversion.

b) *The Project Method.* Topics lending themselves to " project " treatment are given in the prescriptions for each class. This raises the question of the extent to which the traditional logical treatment of arithmetic should give way to a programme organised around centres of interest. In this connection the following statement in a recent report *(Arithmetic in Junior Schools,* p. 49) is worthy of consideration :—

" The necessity of logical development in the teaching of arithmetic and the importance of completely mastering one process of calculation before a new step is attempted combine to make this subject traditionally one of the most abstract and academic in the curriculum of the elementary school. Although it is true that some children find satisfaction in the correct working of sums that are either purely mechanical or are solutions of quite unreal problems, it is now realized that children in the junior school reach a better command of the arithmetic they will need to use in adult life if they are trained in the early years to work out calculations which they themselves require to enable them to make something or to understand a real situation. This is the essence of the project method. Where a class or group of children need to measure, to count or to reckon before they can carry out an interesting scheme such as the construction of a model railway-station, the printing and selling of tickets for a school entertainment, or the making of a hutch for a class pet, they will be using their number knowledge as a means to that end. For the majority of children this is the best stimulus and should be used whenever the occasion offers. There will be some interests, such as transport, newspapers, the post-office, which will be deepened and enriched if quantitative comparisons are made and experiences requiring measuring, counting, weighing and trading are included. These types of project may well be used to give meaning to arithmetic and to give the children practice in calculations through pleasing and natural occupations. At any period in the junior school the appearance of a strong interest of this kind should be welcomed and fully used. There are, however, two limitations to the amount of arithmetic that can be so taught. The first is the obvious logical difficulty that a numerical process cannot be learnt unless the necessary preliminary processes are known. No attempt should be made to force the children beyond the steps that they can happily and satisfactorily manage at this stage, no matter how excellent an opportunity the project appears to offer. The second is less obvious but of equal importance ; if a project is used as the pretext for introducing arithmetic which is not in fact necessary to it, nor is felt by the children to add to its interest or understanding, then the project fails in its main purpose, namely, to provide a motive for learning or a suitable setting for occupations spontaneously enjoyed by the children.

“ If projects and interests are allowed to develop at intervals during the course... such arithmetic as is essential to them will be learnt, but the committee would urge the importance of keeping a logical scheme intact and of providing regular opportunity of practice in arithmetic skills. ”

This view is endorsed ; and it is realized further that present conditions, both in the small all-class country school and in the large classes of town and city schools, make it impossible to go as far in project work as some would consider theoretically desirable.

c) *Vocabulary*. Failure in arithmetic is sometimes due not to any inability to grasp numerical relations, but to partial or complete ignorance of the meaning of terms ; and such ignorance is often more widespread than is generally supposed. In an effort to encourage greater attention to the vocabulary of arithmetic there has been appended to the prescription for each class a list of some of the terms that should be known.

The use of lively number readers, especially in Primers 3 and 4 and Standard I, is also recommended.

Much attention has been given in recent years to equipping the schools with apparatus that will enable the children to grasp the principles of arithmetical processes by practical experience in contrast to rote learning and mass teaching. In the infant room much material has been supplied in the way of coloured blocks and sticks, dominoes, dice, balls, number games, cards, beads, jig-saw puzzles, etc., which enable the pupils to discover and be trained in number facts in a highly interesting manner. They must develop ideas concerning size, quantity and even weight, for simple balances are provided, enabling them to weigh one article against another.

These methods are continued in the " standards " and apparatus is supplied to enable the children in a practical manner to grasp the exact and comparative values of the various weights and measures. Cardboard coins are also supplied in ample quantity, and actual weighing and measuring are expected to play a prominent part, not only in the original teaching of new processes, but also in subsequent problems and exercises.

The New Zealand Education Department began to publish its own textbooks about three years ago. They were compiled by one of the most highly skilled headmasters (the head of a normal school, to which a training college is attached) and he had the cooperation of teachers and inspectors. They were approved by the Department before going to print.

These textbooks are to be revised in the near future, in the light of experience of books already published, by a senior inspector of schools who will have the assistance of a committee of expert teachers in each of New Zealand's nine Education Districts.

Activity methods wholly replace textbooks only in the " primer " classes, and the number apparatus supplied is expected to compensate.

MISCELLANEOUS

The present arithmetic and other syllabuses were revised and published in 1948 (see *Revised Syllabuses*, New Zealand Education Department). The main reasons for modifying the arithmetic syllabus were as follows :—

a) The demands the old syllabus made on children of ordinary abilities were excessive unless an undue amount of time was devoted to arithmetic. This could not reasonably be done, because, since the introduction of the former syllabus, important fresh activities have been introduced into the curriculum and require a portion of the school time. This is one of the reasons why few teachers gave their classes as much practical work in arithmetic as the former syllabus suggested. It was believed by some, shortsightedly perhaps, that examination requirements could best be met by concentrating severely on drills and oral and written exercises. Since the abolition of the Proficiency Examination arithmetic has received something more approximating its fair share of school time, but many schools have attempted to cover nearly the same amount of ground as before, with the result that the work attempted is often very incompletely mastered. All this has pointed to the need for such reduction in the scope of the former syllabus as will permit what is actually learned to be learned thoroughly. Thoroughness is a keynote in arithmetic.

b) With the virtual disappearance of formal number teaching in the infant department, i.e., of drills designed to fix number facts and of the working of examples on paper without reference to concrete situations, children will come up to " Standard I " with less systematized knowledge than in the past and with less knowledge of arithmetical symbolism. They will, it is true, have a considerable experience of number ; indeed, a well-devised activity programme should give them a clearer understanding of number relations and a greater confidence in handling situations involving them than were usually achieved by children taught in the old way. Nevertheless, the change calls for adjustments in the " Standard I " programme so as to maintain continuity of development and to avoid overloading this class with formal work. Anything in the nature of a sharp break is to be strongly deprecated. On the contrary, it is most desirable that the activity in shopping, measuring, weighing, pattern-making with geometrical shapes, etc., which takes a large place in a good infant programme should be continued at progressively higher levels in the " standard " classes. Such necessary adjustments in the " Standard I " programme have in turn to be taken into account in the " Standard II " programme, and so on with the other classes.

c) The problem, however, is not merely one of lightening the syllabus by omitting certain things altogether and transferring topics from one class to a higher class. Because much arithmetic has in the past been a time-consuming task for many children there is a tendency in some quarters to demand that what is taught be reduced to the bare minimum necessary for strictly utilitarian purposes—a not unnatural reaction that has been described as " the flight from arithmetic ". Educationally this view is unacceptable as arithmetic rightly conceived and rightly taught can have cultural as well as utilitarian values even for the average child of primary-school age. Some arithmetic still commonly taught in our schools has no counterpart in reality and for too many children the subject consists of little more than the manipulation of the pruning-knife. In fact, the former syllabus, in its recurring stress on practical work and its explicit condemnation of laborious and useless exercises in, for example, the four rules applied to weights and measures, gave a clear lead that has not always been followed to the degree that is possible.

The main changes, which follow largely from these general principles, are summarized below :—

a) In all classes there are cuts in the scope and complexity of the work prescribed. For example, the various processes in division, by far the most difficult of the four rules, are in general stepped forward one class ; work in fractions has been simplified ; the application of the four rules up to the limits of numeration and notation is not now required, and with " Standards I-IV " these limits have themselves been set at lower levels ; certain processes not in common use, e.g., square root, have been excluded.

The placing of definite limits on the quantities, the number and type of denominations, and the complexity of process involved in the varying types of exercises implies more than the general need for a simplification of the programme. Many simple examples normally provide better practice than a few complex ones. In the adult world, moreover, laborious computations are to an increasing extent carried out with the aid of ready-reckoners and calculating machines. In the higher classes the children should actually be taught to construct and use ready-reckoners not only because they are efficient time-savers, but also because work with them provides a good introduction to tabulation.

b) Practical activities with weights and measures appear earlier. As is noted above, work of this kind is now a feature of good infant programmes, and it should be continued and developed, thus ensuring a thorough comprehension of the significance of the basic units—a rarer thing than is often supposed. Further, these practical activities should help to counteract the tendency, especially marked in " Standards I and II ", to concentrate too narrowly on mechanical operations, and they should at the same time give the mechanical operations fuller meaning by calling for their use in a wide variety of situations. Exercises in weights and measures should be restricted to sensible and real situations. For this reason in " Standard IV " to " Form II " the work has been incorporated with social arithmetic. It should be noted that in everyday life most of the units are used singly (e.g., miles—of fractional parts—for longer distances, yards for shorter, chains for fencing, gallons or pints for liquids), and in only a few cases (e.g., heights, weights, ages of persons, and weights of loads) are units used together, and rarely more than two at one time. For this reason there is slender, if any, justification for abstract drills in the four rules applied to weights and measures.

c) The inclusion of " spatial knowledge " in the programme for " Standards I, II and III " is a new departure. Cognizance has been taken of the lead of those authorities (including the committee responsible for the Hadow Report on the Primary School) who have recently called attention to the neglect in the junior school of the study of geometrical form. " Interest in shapes, " it has been said, " is older than the Egyptian pyramids and as new as the latest examples of modern architecture, " while " the basic ideas of geometry—viz., symmetry, size, and position (including orientation or lie)— are as important as counting and serve as a means of mental development particularly stimulating to children who find difficulty in work with abstract number " *(Arithmetic in Junior Schools*, prepared by the mathematics section of the Metropolitan Branch of the Training College Association, London, 1940, pp. 8-9). The child's interest in shapes is, in fact, recognized in the infant department with its form-boards, jig-saw, blocks, paper-tearing, and paper-cutting, etc., but geometrical work is thereafter often completely neglected until " Standard IV ", when the construction of figures is begun. It is true that some constructional activities of the type suggested are already done in handwork periods, but there is not often any serious attempt to use such activities as a means of developing geometrical ideas. It is considered, therefore, that spatial knowledge has very good claims for inclusion in the junior school programme.

d) More social arithmetic, i.e., application of arithmetic to domestic, economic and civic conditions of life, is prescribed in all standards. The shopping games and kindred activities of the infant department should lead in an orderly way to the home and school problems of the junior school and thence to a broadly conceived social arithmetic in the senior school. In the past there has been much bias in the direction of commercial arithmetic, while domestic and civic arithmetic have been treated somewhat narrowly. Commercial arithmetic in its more technical aspects should be postponed to the post-primary stage, while civic arithmetic should be " humanized " by bringing it into closer touch with the day-to-day concerns of the ordinary person.

Suggestions on the construction and interpretation of tables and graphs with the use of data derived from the Year-Book and other sources have been included. The ability to extract meaning from tables and graphs and to read them critically should be part of the equipment of every citizen, but it is much less common than it ought to be. By selecting data of real significance teachers can, while developing skill in interpretation, do much at the same time to extend the range of children's knowledge.

NICARAGUA

From the reply sent by the Ministry of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

A subject called *aritmética y geometría* (arithmetic and geometry) is taught from the 1st year (children of six years) onwards in Nicaraguan primary schools. Four periods (of about forty minutes) are devoted to it in the first three classes, and five periods a week in the remaining classes.

Learning the first concrete notions of geometry begins in the 1st year.

SYLLABUSES

The principal points in the syllabus are as follows :—

1st year : developing the notion of quantity ; numeration up to 9, notion of a dozen, then numeration up to 100 ; addition and subtraction, and simple problems relating to the environment ; notion of multiplication, the multiplication sign, and making the 2-, 3-, 4- and 5-times multiplication tables ; oral division in a concrete form of numbers up to 20 ; the division sign, written exercises with two-digit dividends and one-digit divisors, and simple problems ; notions of fractions ($^1/_2$, $^1/_3$, $^1/_4$ and so on down to $^1/_{10}$, then $^2/_3$, $^2/_5$, $^3/_4$ and so on) ; simple exercises and problems with addition and subtraction of fractions having the same denominator ; measuring lengths with the hand, arm, paces, etc. ; making measuring instruments ; Roman notation up to 12, and application to telling the time ; measures of time, names of the days and months ; measuring capacity with bottles of water ; knowledge of coins ($^1/_2$, 1, 5, 10 and 25 *centavos*) ; geometrical forms, lines and angles.

2nd year : revision of the 1st year syllabus ; acquiring notion of a hundred with the aid of concrete exercises ; counting in tens and hundreds ; notion of a thousand ; problems with the four operations ; making and memorising 6-, 7- and 8-times multiplication tables ; reduction of fractions to the same denominator ; simple addition and subtraction of fractions ; decimal fractions ; common measures ; notion of the decimal system ; regular geometrical solids.

3rd year : revision of work done previously ; numeration up to 10,000 ; addition and subtraction with four-digit numbers ; making

9-, 10- and 11-times multiplication tables ; multiplication with two-digit multipliers and division with one-digit divisors ; addition and subtraction of fractions ; decimals ; changing decimal numbers into fractions and vice-versa ; the square metre and subdivisions ; continued practice with measures of capacity and of weight ; the national currency ; metric abbreviations ; notions of circumference and chord, triangle, quadrilaterals and regular polygons.

4th year: revision of work done previously ; numeration up to 100,000 and notation up to 1,000,000 ; the four operations with whole, decimal and fractional numbers ; divisibility by 2, 3 and 4, and use in simplifying fractions ; keeping an account of personal expenditure ; time between two dates, calculation of age ; making out bills ; study of old weights and measures ; graphs ; areas of triangles, squares and rectangles, and construction of these figures ; divisions of the circumference.

5th year: calculating fractions of numbers ; unitary method ; percentages ; relationship between percentages and fractions ($50\,\% = 1/_2$, $25\,\% = 1/_4$, etc.) ; common commercial problems ; discount ; thorough revision, as far as possible by means of practical exercises, of whole system of weights and measures ; currencies of countries trading with Nicaragua ; problems on exchange rates ; notions of statistics ; areas of trapezia, polygons and circles ; division of circumference in degrees ; measuring angles with a protractor.

6th class: revision of work done in previous classes ; compound rule of three ; calculating simple interest and percentages with the use of the compound rule of three, unitary method ; formulas for simple interest ; ratio and proportion, and application to calculation of interest ; banking documents ; proportional division ; direct taxes ; money orders ; powers (squares of numbers up to 10) ; notions of bookkeeping ; idea of credit, security, balance, cancellation ; inventories ; volume of cube, cylinder, and prism, and application to calculating capacity of barrels, reservoirs and silos.

In all classes, practical exercises play a great part in acquiring and retaining knowledge.

METHODS

The official syllabuses are very detailed, and thus in effect constitute recommendations as to method. A teacher's presentation should be concrete, there should be a close connection between all exercises and the problems that arise in the children's environment, and difficulties should be very carefully graded.

Teaching materials are important, inasmuch as lessons should be given in a concrete way, but they are found mainly in the surroundings.

The greatest care has been given to the preparation of textbooks in harmony with the syllabus.

NORWAY

From the reply sent by the Ministry of Religion and Education

PLACE OF MATHEMATICS IN THE CURRICULUM

A subject called *Regning* (arithmetic) is taught in Norwegian primary schools from the 1st class (children of seven years old) onwards. Three to six hours a week, according to the class and type of school, are devoted to it.

Geometry is not taught as a separate subject at primary level, but is touched on during the lessons on arithmetic.

SYLLABUSES

The essential points of the arithmetic syllabus are as follows :—

1st class: numeration, addition and subtraction up to 100; introduction to the use of money and measures (crown and øre, metre and centimetre).

2nd class: numeration, addition and subtraction up to 1,000; crown and øre, kilogram and gram, metre and centimetre, litre and decilitre, and addition and subtraction of quantities expressed in these pairs of units ; year, month, week, day, hour ; problems (one operation only).

3rd class: making and learning multiplication tables ; numeration up to 10,000 ; additions up to six four-digit lines ; multiplication of a two- or three-digit number by a one- or two-digit number ; division without remainder ; notions of fractions ; multiplication by 10, 100 and 1,000 ; simple problems.

4th class: continuation and extension of addition and subtraction exercises ; learning the multiplication facts so as to gain complete confidence ; multiplication of four-digit by two-digit numbers ; division with remainder of four-digit by two-digit numbers ; finding a fraction of a number ; exercises on the use of money, weights and measures ; addition, subtraction and multiplication with decimals ; problems involving up to two operations.

5th class: multiplication of four-digit by four-digit numbers ; division of five-digit by two-digit numbers ; multiplication of decimals by two-digit whole numbers ; addition and subtraction of fractions with the same denominator ; prime numbers ; addition and subtraction of fractions with small denominators (without using L.C.M.) ; multiplication and division of fraction by a whole number ; exercises on weights and measures in common use ; problems involving two operations.

6th class: the four operations with whole numbers and fractions (common denominator not over 16) ; conversion of fractions into decimals, and vice-versa ; the four operations with decimals ; percentages ; perimeter and area of rectangles, parallelograms, squares and triangles.

7th class: the four operations with whole numbers, decimals and fractions ; percentages ; using tables to calculate interest ; elementary bookkeeping ; foreign currencies ; area of circles, and length of circumference ; measures of capacity ; surface-area and volume of rectangular prisms and cylinders.

In all classes, practical work is an internal part of any lesson on new material. It is sometimes difficult to say where geography—or physics—ends, and arithmetic begins, and these subjects are therefore studied in close relation with each other.

AIMS

The primary arithmetic syllabus aims at enabling children to form useful ideas of quantity and space, and to put such ideas to good account.

METHODS

The official primary curriculum includes suggestions on the method of arithmetic. They insist that teaching should be very carefully graded, and stress the importance of the handling of concrete objects in the lower classes, and the need at all levels for children as far as possible to learn individually and to be set to solving problems which they have themselves raised.

Use is made in teaching arithmetic, of a number of games, produced in Norway or Denmark, and various pictures. Textbooks exist approved for use in primary schools.

MISCELLANEOUS

The suggestions to teachers may be found in the official curricula " Normalplan for Landsfolkeskolen " (Oslo, 1940) and " Normalplan for Byfolkeskolen " (Oslo, 1948). Dr. B. RIBSSKOG's " Regning " (Oslo, 1935) should also be noted.

PAKISTAN

Karachi

From the reply sent by the Inspector of Schools concerning St. Josephs' Convent High School, St. Patrick High School and Karachi Grammar School

PLACE OF MATHEMATICS IN THE CURRICULUM

Arithmetic is taught from the kindergarten class (children of five years of age) onwards, and is generally given under such heading. At Karachi Grammar School, however, number work is the term used in the kindergarten and the junior preparatory, and arithmetic and geometry in standard III senior preparatory. Five periods a week of forty minutes each are generally devoted to it (eight periods in the senior preparatory).

At St. Joseph's High School, geometry is referred to in arithmetic lessons; in Karachi Grammar School, it is first introduced in Standard III; it is not taught in the primary classes of St. Patrick High School.

SYLLABUSES

The outline of mathematics contained in the *St. Joseph's Convent High School*'s curriculum includes :—

Kindergarten, Class IV (two divisions) : counting ; addition and subtraction of numbers up to 10. *Class III* (two divisions) : counting ; addition and subtraction ; tables (2, 3 and 4). *Class II* (two divisions) : addition and subtraction ; tables (5, 6, 7). *Class I* (two divisions) : addition and subtraction ; tables (8, 9 and 10).

Standard I: simple addition, subtraction, multiplication and division.

Standard II: reduction, addition and subtraction of amounts of money ; multiplication and division ; length and weight.

Standard III: weights and measures ; time ; money ; unitary method ; areas.

STATE INSTITUTE OF EDUCATION ★ BANIPUR ★

At *St. Patrick High School*, the main points dealt with are :—

1st year : counting up to 100 ; notation up to 20 ; addition of units.
2nd year : addition and subtraction.
3rd year : multiplication and division.
4th year : the four operations and Indian and British money.
5th year : revision of previous work ; fractions.
6th year : revision of work previously done ; decimals ; buying and selling.

At *Karachi Grammar School* the matters dealt with are briefly as follows :—

Kindergarten : writing of numbers up to 100 ; counting ; addition of two-digit numbers ; multiplication tables up to 10 × 12.

Junior preparatory : continued practice in numbers.

Senior preparatory : Standard I : addition (3 rows), subtraction, multiplication, division ; shopping and reduction of amounts of money ; feet and inches, fractions. *Standard II :* short and long multiplication and division ; rupees, annas, pies ; yards, feet, inches ; lbs, ounces ; gallons, quarts, pints ; the clock. *Standard III :* long multiplication and division ; shopping, multiplication and division and reduction of amounts of money ; yards, feet, inches (addition and subtraction) ; miles, furlongs, chains ; hours, minutes and seconds (multiplication and division) ; stone, pound, ounce, ton, cwt, quarter, maund, seer, chatack (reduction) ; unitary method ; sharing ; sixths, tenths, twelfths, sixteenths ; mixed numbers ; multiplication of mixed numbers by a whole number, and of a whole number by a fraction ; number codes, rules of signs, areas, elementary geometry.

Everywhere, the importance of practical work is stressed, and children may be introduced to mathematical ideas incidentally in connection with other subjects, e.g., circles in geography.

A failure in arithmetic debars a child from being promoted to a higher class.

AIMS

Arithmetic aims at sharpening the intellect and at quick thinking (Karachi Grammar School), and at making a child familiar with abstract quantities and operations with them (St. Patrick High School).

METHODS

Abstract ideas are taught by means of concrete objects, and mental work is given as much importance as written work.

Many teaching aids are used, including ball-frames, objects like marbles, counting sticks, Montessori apparatus, number boards, abacus, beads, puzzles, real or imitation coins, foot-rules, builder's tapes, a pair of scales with a set of weights, and measures of capacity.

Textbooks are used, and are among the very best available.

Baluchistan

From the reply sent by the Director of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Arithmetic begins in the 1st primary class, at the age of five plus. Eight periods a week are usually devoted to it in the 1st class, twelve periods in the 2nd and 3rd classes, and sixteen periods in the 4th and 5th classes. A period usually lasts thirty minutes.

Geometry is not a separate subject in primary classes. Elementary geometry is, however, taught in these classes incidentally.

SYLLABUSES

The syllabus adopted in the Primary Department is the Punjab revised syllabus.

Practical work forms a vital part of arithmetic lessons and it precedes oral and written work. Every possible opportunity is utilised.

The teaching of arithmetic is correlated with the teaching of Urdu, geography and practical arts.

Arithmetic is a compulsory subject in the examinations and is given top priority in promotions.

AIMS

The two chief aims of the teaching of mathematics are :—

(i) to develop a child's intelligence and train his powers of abstraction, judgment and reasoning ;

(ii) to make him skilful in operations with numbers likely to be of use in daily life.

METHODS

Generally speaking, the instructions issued by the Punjab Education Department on methods of teaching mathematics are followed.

Concrete articles and games are the teaching aids, together with suitable books selected by the textbook committee.

East Bengal

From the reply sent by the Director of Public Instruction

Place of Mathematics in the Curriculum

Arithmetic is taught in primary schools from class I (children of six to seven years of age) onwards. Six periods a week (three hours) are devoted to this subject in each class.

Geometry is not taught in primary schools.

Methods

Instruction is given with the aid of concrete objects such as seeds, marbles and coins, and of textbooks approved by the textbook committee.

North-Western Frontier Province

From the reply sent by the Director of Public Instruction

Place of Mathematics in the Curriculum

Arithmetic is taught from the first primary class (five years of age) onwards. Twelve periods a week are devoted to this subject.

Geometry is not included in the primary curriculum.

Syllabuses

The matters dealt with are briefly as follows :—

1st class : to write and name the numbers up to 100 ; addition and subtraction first with concrete objects, and afterwards mentally up to 20 ; multiplication tables up to 6×16.

2nd class : comprehension of numbers up to 10,000,000 ; the four simple rules (division and multiplication with numbers below 1,000) ; multiplication tables up to 16×16.

3rd class : the four compound rules with reduction and estimation of lengths and distances at sight ; reading the clock.

4th class : H.C.F., L.C.M. ; simple fractions, unitary method, simple interest according to unitary method ; fractional tables $(^3/_4, 1^1/_4, 1^1/_2 \times 16)$.

Very little practical work is done.

Passing references may be made to mathematics in literature, geography and nature study lessons.

Arithmetic is a compulsory subject in the yearly and school leaving examinations.

METHODS

There are no special instructions as to method, but suggestions contained in books on methods of teaching mathematics are referred to.

The main teaching aids are the abacus for the four fundamentals and pictorial charts for fractions.

The official instructions require the use of textbooks from the 2nd class onwards. The books are approved by the textbook committee.

Punjab

From the reply sent by the Director of Public Instruction

PLACE OF MATHEMATICS IN THE CURRICULUM

Formal teaching of arithmetic begins at the primary stage to which children are admitted at the age of five. About eleven periods a week covering five and a half hours of teaching, are devoted to the subject.

Rectangular areas are included in arithmetic in the 4th class.

SYLLABUSES

The matters dealt with are briefly as follows :—

Class I : numeration and notation up to 100 ; multiplication tables up to 10×10.

Class II : multiplication tables up to 16×16 and first four simple rules.

Class III : multiplication tables of $1\frac{1}{2}$ and $1\frac{1}{4}$ up to 16 ; first four simple rules involving tables of money.

Class IV : multiplication tables of $2\frac{1}{2}$ up to 16 ; tables of weight, length and quantity ; rectangular areas ; interest.

Class V (girls' schools) : fractions, unitary method. (Boys' primary schools have at present only four classes.)

A good deal of stress is laid on practical work throughout the primary stage, particularly in the first two classes.

The teaching of arithmetic is correlated with the surrounding life of the place where the school is situated.

In the examinations, arithmetic is a compulsory subject, failure in which debars a child from promotion.

AIMS

The aim of teaching mathematics at the primary school stage is to enable a pupil to acquire the ability to apply number to everyday problems and appreciate spatial relations likely to be of use to him in daily life.

METHODS

According to the aims mentioned above, a teacher should endeavour through concrete examples to explain to his pupils the rationale of fundamental processes, and train them rapidly to gain accuracy and confidence in calculations. The method most commonly employed is the inductive method.

Beads, marbles, sticks, actual weights and measures, play-way devices, and Montessori sensorial apparatus wherever possible, are the teaching aids commonly used.

The use of textbooks is required. They are submitted by authors and publishers to the Punjab Advisory Board for Books, which then recommends suitable ones to the government for approval.

MISCELLANEOUS

On the creation of the State of Pakistan, the existing syllabuses were submitted to careful scrutiny by a special committee. The revised syllabuses are now in the press and will be put into effect from 1st April, 1951, when the new textbooks prepared according to the revised syllabuses will become available.

Sind

From the reply sent by the Director of Public Instruction

PLACE OF MATHEMATICS IN THE CURRICULUM

In the nursery-infant class (the Montessori class attached to the practice school of the Training College for Men) the first teaching of arithmetic begins at the age of four years. In primary schools arithmetic is taught from the age of six years to thirteen years, i.e., from the 1st to the 7th standard.

Geometry is not taught as a separate subject below the age of 11 years, i.e., below the 5th standard post-primary. Geometry is taught as a separate subject from the age of eleven to fifteen years, i.e., from standard V to VII (post-primary classes), and is treated as such in the class time-tables.

Seven periods per week, each period of forty-five minutes duration, are devoted to the teaching of arithmetic, and in post-primary classes three additional periods are devoted to geometry.

SYLLABUSES

The matters taught as arithmetic in the lower primary classes are in brief :—

Infant class: a thorough knowledge of numbers up to 10 through the use of concrete examples and educational games.

1st standard primary (age 6-7 years) : the extension of the idea of ten to two tens, three tens and so on up to a hundred ; counting up to 100 and recording numbers on the abacus and thus familiarising the pupils with the idea of positional value ; counting by twos, threes, fours, fives and tens up to 100 and thus laying a sound foundation for the multiplication tables ; learning, from concrete examples, simple addition and subtraction of two numbers, the sum of which does not exceed fifty and without changing tens.

2nd standard primary: a thorough revision of the work done in the 1st standard ; numeration up to 10,000 ; a thorough knowledge of units, tens and hundreds and ample practice in writing large numbers in figures from dictated words ; examples, in addition and subtraction, in which there is change of tens and hundreds in calculation ; construction and thorough mastery of multiplication tables at least up to 10×10 extending to 12×12 ; examples of simple multiplication and division, the multiplier or the divisor being one-digit figures only ; a thorough knowledge and use of the signs ; concrete examples in addition, subtraction, multiplication and division, either of a practical nature or drawn from everyday life (particular attention being given to examples of addition and subtraction with native money : rupees, annas, pies, etc.).

3rd standard primary: a thorough revision of fundamental processes applied to numbers and money included in addition, subtraction, multiplication, division, mainly through oral or mental work ; further extension of numeration and notation up to a million ; construction and thorough mastery of tables up to 20×20, and use of tables involving money, weights and measures, and time ; a thorough knowledge of the idea of $^1/_2$, $^1/_4$ and $^3/_4$ and the practical application of the same.

4th standard primary: a thorough revision of the work applied as far as possible to concrete examples either of a practical nature or drawn from everyday life ; a thorough knowledge, use and application of $^1/_2$, $^1/_4$, $^3/_4$, $1^1/_4$, $1^1/_2$, $2^1/_2$; harder examples of multiplication and division, multipliers and divisors being two- or three-digit numbers ; multiplication and division ; rule of three involving unitary method ; a thorough knowledge and application of tables involving English money, weights and measures ; simple interest and simple household accounts.

Great importance is given to practical work done by the children in the classroom as well as for homework. Simple problems bearing on the children's everyday life are given in mental work, which invariably precedes written work.

Great importance too is attached to mathematics in the yearly and primary school leaving certificate examinations, for the following reasons :—

i) it is recognised that arithmetic is taught because of its usefulness and the training it gives to the mind in reasoning and logical thinking ;

ii) the modern industrial system and the part played by science in a modern civilized community make great demands upon the mathematical knowledge of the ordinary citizen ;

iii) it is recognised that arithmetical knowledge is indispensable for providing the necessary facility to the pupil in his after-school life.

AIMS

According to the instructions given in the curriculum for primary schools, arithmetic is taught a) to acquaint a pupil with the type of every example useful to him in his after life, b) to train him to solve problems with speed and accuracy and give him mental training.

METHODS

There are no hard and fast rules laid down by the Department for the teaching of this subject. However, suggestions of a general type are given in the curriculum prescribed for primary training institutions. Mental work should invariably precede written work. Concrete examples should be used as far as possible, but the examples should always deal with the objects and facts within the knowledge and experience of pupils. Long intricate calculations should be avoided.

In lower primary classes, children use coins, weights, abacus, beads and other aids while mastering various tables to be applied to the problems given to them for solution in classroom as well as for homework.

No textbooks or printed exercises are used in nursery, infant or lower primary classes. In nursery and infant classes the work is mainly done with the help of educational games such as " numerical rats ". In lower primary classes, the work is mainly oral and greater importance is given to mental arithmetic and sometimes teachers teach by simple exercises about simple shopping transactions involving the use of local money or simple measurements applied as far as possible to concrete examples of a practical nature drawn from the children's everyday life.

PERSIA

From the reply sent by the Ministry of National Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Introduction to mathematics begins in the nursery-infant schools (children from three to six years of age) in Persia.

In the primary schools, to the subject called "arithmetic and geometry", two hours a week are devoted in the 1st class, three hours in the 2nd class, four hours in the 3rd and 4th classes, five hours in the 5th class, and four hours in the 6th class. Geometry begins in the 2nd class.

SYLLABUSES

The principal points in the syllabus are as follows :—

Nursery-infant schools: numeration up to 20 ; simple addition and subtraction with whole numbers up to 20.

1st class: oral and written numeration up to 100 ; addition and subtraction with objects and whole numbers up to 100 ; counting objects by two's, by three's, by four's.

2nd class: Arithmetic : oral and written numeration up to 1,000 ; addition and subtraction ; beginning of multiplication ; notions of the standard measures (metre, kilogram, rial). Geometry : estimating distances, and checking by measuring ; drawing and construction of geometrical figures (triangles, squares, etc.).

3rd class: the four operations with whole numbers ; arithmetic exercises on sizes measured by the children.

4th class: Arithmetic : complex numbers ; revision and deeper study of work done in previous year ; notions of ordinary and decimal fractions ; oral and written exercises. Geometry : careful revision of work done ; circumference and its division into degrees ; ellipse ; practical rules for calculating the area of triangles, squares, rectangles and circles ; solving problems.

4th class: Arithmetic : divisibility of a whole number by numbers up to 10 ; definition of ordinary fractions ; simplification, addition, subtraction, multiplication and division of vulgar fractions ; conversion of ordinary into decimal fractions, and vice-versa ; ratios and proportions ; problems with the rule of three ; various problems, oral and written exercises. Geometry : areas of plane figures ; oral and written exercises ; notions of geometrical solids ; measurement of angles.

6th class: Arithmetic : careful revision of work done the previous year ; compound rule of three ; simple interest ; proportional division ; mixtures and alloys ; problems ; keeping monthly accounts. Geometry : definition and measurement of volumes and capacities ; volume of prisms, pyramids, cones, cylinders and spheres; oral and written calculation of certain areas and volumes.

At all levels teachers endeavour to support their teaching with concrete examples and applications. They may also teach mathematical ideas incidentally during other lessons.

In the yearly and school-leaving examinations, the same importance is attached to mathematics as to the mother tongue.

AIMS

The object of the introduction to mathematics in Persian primary schools is to develop children's ability to think in abstract terms, and to teach them to calculate accurately.

METHODS

The methods used are generally those advocated by modern European and American educationists.

In the nursery-infant schools, arithmetic is taught in a concrete way and great importance is attached to exercises. In the primary schools, an endeavour is made to temper the austerity of the subject by making it more general in character and by turning to good account the children's ability to observe. The teaching materials used thus consist mainly of toys, lottos, balls, marbles, matches, rulers and compasses, and the surface-areas of the various books used by the class.

Educational games are used only in the nursery-infant schools.

Official instructions recommend the use of various textbooks and lists of problems graded according to the children's ages.

MISCELLANEOUS

Dr. Fatemi, professor at the University of Teheran, recently completed a number of textbooks for improving the teaching of arithmetic and easing the work of teachers.

PERU

From the reply sent by the Ministry of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Children acquire their first notions of mathematics in Peru when they are about six years old, in the transition class between the nursery-infant school and the primary school. The subject is called *iniciación en el cálculo* (introduction to arithmetic), and twenty to thirty minutes a day are devoted to it.

In the first two classes of the primary school, teaching has an integral, "global" character. Twenty to thirty minutes a day are devoted to what are called *ejercicios de fijación* (retention exercises).

In the 3rd and 4th primary classes, the various subjects in the curriculum are taught in an articulated way. One hour every two two days is generally reserved for *cálculo* (arithmetic).

In the 5th and 6th classes, the mother tongue and arithmetic are of equal importance.

The arithmetic syllabus covers both arithmetic and geometry.

SYLLABUSES

The mathematics syllabus is both integral and graded, and each new item in it is based on the work already done. Its principal points are as follows :—

Transition class : numeration up to 10 ; uniting, adding to, taking away, grouping and dividing objects ; simple additions and subtractions in concrete, diagrammatic and numerical fashion with quantities up to 10, and (after numeration up to 20) up to 20 ; simple buying and selling, using coins in common use up to one *sol* ; measuring the length of certain objects and short distances with the hand and by pacing, and judging weight by comparing.

1st year : synthesis and analysis of numbers up to 10 ; notion of ten's, numeration up to 100 ; use of terms "plus", "minus", "equals", "into" and "between" ; dozens and half-dozens ; definite ideas of the metre, decametre, centimetre and kilogram ; Roman notation up to 12, telling the time ; days and months ; the four operations with numbers up to 20, then to 50 ; notions of rectangles, squares, spheres, cubes and cylinders ; money up to a *sol*, and its relation to the decimal system.

2nd year: revision of previous year's work ; the four operations with numbers up to 100, 300 and then 500; numeration up to 1,000; decimals with money ; Roman notation up to 30 ; local weights and measures ; squares, rectangles and triangles, and concrete notions of spheres, cylinders, cones and pyramids ; examples of fractions.

3rd year: numeration up to 10,000 ; the four operations ; metre, decimetre and millimetre ; decametre, hectometre and kilometre ; scales for weighing ; kilogram and gram ; the litre and other common measures; the four operations with decimals; circle, circumference, triangle, angles, lines, etc. ; Roman notation up to 100 ; the gold *sol*, notation of monetary fractions ; notions of fractions, conversion of fractions into decimals.

4th year: weights, and measures of length and capacity ; measures of area and agrarian measures; the four operations with fractions ; notions of percentages, and expressing a percentage in decimals or as a fraction ; unitary method ; the more common business documents ; receipts, securities, bills of exchange ; money orders, transfers, cheques and bills.

5th year: area of squares, rectangles and triangles ; the principal agrarian measures and their equivalents ; regular polygons and their areas ; circumference and circle ; the scale of a plan or a map, and conventional signs ; cubic metres and decametres ; relation between the litre, kilogram and cubic decimetre ; the litre and the gram, and their multiples and sub-multiples ; old-time weights and their metric equivalents.

6th year: numeration and notation ; the four operations with decimals and fractions ; metric measures and metric equivalents of certain old-time measures ; calculating income and discount ; proportional division ; Peruvian and some foreign currencies ; foreign exchange ; examples of geometrical solids.

Exercises play a very big part in learning and memorising the work done. They consist mainly of measuring, calculating, and solving problems taken from the environment or from the various school activities, handwork especially.

Mathematics is the most important subject in all the yearly examinations.

AIMS

The objects of teaching mathematics in the primary schools are to enable a child to solve everyday arithmetical problems quickly and accurately, to grasp and understand the quantitative aspects of his surroundings, and to develop his powers of reasoning.

METHODS

The primary " plan of studies " and curriculum contains recommendations on the teaching of mathematics. Teachers are advised to use activity methods, and to present the subject in a concrete and practical way. The tendency of the recommendations is especially noticeable in the choice of teaching materials, which are to be taken from the environment and which, according to the class, consist of marbles, maize seeds, matches, colour cards or various tariffs and price-lists. In the lower classes, educational games are also used.

Official instructions recommend the use of books as works of reference. Children may therefore need to consult several books, and libraries should for this reason be established. Certain books, specially written for certain classes, are approved by the Ministry.

MISCELLANEOUS

The present primary curriculum is in keeping with the principles of the activity school, and came into force roughly five years ago, replacing an " analytical " curriculum.

PHILIPPINES

From the reply sent by the Department of Instruction

PLACE OF MATHEMATICS IN THE CURRICULUM

Arithmetic is one of the basic, required subjects in Philippine primary and intermediate schools, and includes geometrical concepts from grade I onwards.

SYLLABUSES

Arithmetic in primary and intermediate classes is a tool subject; it develops accurate thinking with the least loss of time. At all levels, practical exercises cover more than fifty per cent of the work, and efforts are made to correlate the teaching of mathematics with that of other subjects. Much of the correlation takes place in language, reading, industrial arts and social studies.

There are no final examinations. The rating is based upon " quizzes " of the pupils and their daily work. Pupils in grades IV-VI cannot be promoted unless they get a general average of at least 75%. Pupils in grades I-V may be promoted at any time during the first semester and at the end of the school year, if in the opinion of their teachers and the supervisors, they are capable of doing the work of the next grade.

AIMS

The objectives of the teaching of mathematics in the primary grades are a) to give a child command of the fundamental operations in arithmetic ; b) to develop his ability to make application of the fundamental operations to the actual solution of simple daily problems ; c) to develop in him quick, accurate thinking habits in solving problems ; and d) to give him a clear understanding of the meaning of numbers, quantitative relationships, arithmetical signs, etc.

METHODS

Teachers generally use the primary course of arithmetic prepared by the Bureau of Public Schools. There are also teachers' manuals on the method of arithmetic for grades I and II, the laboratory and supervised-study methods being most often used.

Some didactic materials are found in the textbooks. Examples of these are the definitions of terms and the tables of measures and weights. There are definite sets of flash-cards for each grade, and also charts and practice books to help in the mastery of the fundamentals.

Activity and games help very much, especially in drill work. Examples of such games are fishing games, buying and selling, picking fruit, and races in connection with abstract work in the four fundamental operations.

Textbooks adopted by the Board on Textbooks are prescribed and provided for use in public schools. These are either prepared by the Bureau of Public Schools, or written by private authors and approved by the Board. The selection of such books is based on suitability, practicability and social utility.

MISCELLANEOUS

The new course of study stresses the use of practical concrete materials, especially in the lower grades, in connection with the development of number concepts. Materials included merely for mental gymnastics are discarded.

The most recent works on the teaching of mathematics are "Course of Study in Arithmetic for the Primary Grades", and "Course of Study in Arithmetic for the Intermediate Grades", both being publications of the Bureau of Public Schools.

POLAND

From the reply sent by the Ministry of Education

Place of Mathematics in the Curriculum

Introduction to mathematics begins in Poland during the pre-school years (children of three to six years of age), within the framework of activities called “arithmetic exercises”. To such exercises the children devote thirty hours during their first year at this level, eighty during the second, and a hundred during the third.

A subject called arithmetic is taught throughout the seven years of the “basic” school. Six hours a week are devoted to it in the 1st and 2nd, and 4th, 5th and 6th classes, and five hours in the 3rd and 7th.

Notions of geometry form an integral part of arithmetic lessons, and what may properly be called geometry makes its appearance in the 6th class.

Syllabuses

The “arithmetic exercises” of *pre-school education* cover the following items :—

1st class : forming notions of “much” and “little”, “long” and “short”, “high” and “low”, “full” and “empty”, by means of concrete examples ; the first five numbers ; notions of time (day and night, morning, mid-day and evening).

2nd class : synthesis and analysis of 3, 4 and 5 ; counting up to 10 ; quantitative relationships (“much”, “more”, “most” ; “little”, “less”, “least” ; “as much as”) ; recognition of geometrical forms (sphere, cube, cylinder, circle, square, triangle) ; positions (“near”, “far”, “high”, “low”, “above”, “under”, “on”, “in front of”, “behind”) ; comparing and measuring lengths with string or by pacing ; comparing capacities ; notions of weight (“heavy” and “light”) ; notions of time (“for a long time”, “for a short time”, days of the week).

3rd class : synthesis and analysis of the first ten numbers ; notions of pairs, halves and quarters ; counting up to 20 ; visual perception of numerical groups of one to five elements ; recognition of geometrical forms (prisms, cones, quadrilaterals and polygons) ; spatial notions (" in front of ", " behind ", " in the middle ", " to the left ", " to the right ").

The principal points of the arithmetic syllabus for the "*basic*" *school* are as follows :—

1st class: numeration up to 10, 20 and then 100.

2nd class: the four operations within the range of 100.

3rd class: the four operations within the range of 10,000 ; line and circle.

4th class: the four operations with whole numbers ; notions of fractions ; angles ; perpendiculars and parallels ; rectangle ; scale.

5th class: nature of divisibility ; the four operations with fractions ; first notions of decimal fractions and decimals ; areas of rectangles and triangles ; volume of rectangular parellelepipeds.

6th class: the four operations with decimals ; ratio and proportion, proportional division ; interest, percentage ; use of letters to represent numbers ; straight and curved lines ; polygons ; examples of equality of triangles ; parallel lines, parallelograms ; pencil drawings.

7th class: Algebra : positive and negative numbers ; operations with algebraic numbers ; equations of the first degree with numerical coefficients ; systems of equations of the first degree with two unknowns ; notions of function. Geometry : angles at the centre and inscribed angles ; relative positions of line and circle, and of two circles ; similarity ; surface areas ; length of circumference ; relative positions of lines and planes ; calculating areas and volumes (without arriving at formulas).

In all classes, exercises play an important part in learning and memorising knowledge, and in developing the ability to reason. Among others, observation, acquisition and formative exercises, and exercises for acquiring skills, are used.

AIMS

The aim of the arithmetic exercises given in the course of pre-school education is to develop a child's interest in the quantitative and spatial relationships of his surroundings, and to prepare him for formal teaching.

The introduction to mathematics in the " basic " school is expected to teach children to make calculations of use in everyday life, give them a good groundwork in geometry, make them familiar with the quantitative aspects of social phenomena, and enable them to solve the problems in the syllabus.

METHODS

Recommendations on teaching method are given in an appendix to the official arithmetic syllabus. They include some general remarks on the structure and scope of the syllabus, a list of the means of achieving the aims of the subject, information concerning pupils' homework and exercises and the passages in the syllabus on problems, and instructions as to how best to broach new subject-matter.

Teaching materials are deemed very valuable auxiliaries. They consist of pictures, counters, tables, diagrams, scales and weights, instruments for measuring length and capacity, discs of various sizes for teaching notions of fractions, geometrical solids and miscellaneous instruments (ruler, set-square, compass, protractor and the like).

Teaching is always based on a textbook, and each child has his own copy. The same textbooks are used in urban as in rural areas, the exercises being sufficiently numerous to make a suitable choice possible. There is a special textbook for each year.

MISCELLANEOUS

The curricula now in force are in keeping with Poland's present social and economic structure. So far as mathematics are concerned, the latest modifications consist mainly of changes in the subject-matter of the problems. Their commercial elements have been almost entirely eliminated, and replaced by ones more in harmony with the country's new way of life, which includes nationalised production, new conditions of work, and a transformed attitude to culture.

The recent publications on method should be noted of J. F. SZUREK, MACKOWIAK, and L. JELENSKA and M. RUSIECKI.

PORTUGAL

From the reply sent by the Ministry of National Education

Place of Mathematics in the Curriculum

Introduction to mathematics in Portugal begins in the lower primary schools, and is given in all classes under the heading of *aritmética* (arithmetic). Children thus begin to study the subject when they are six or seven years of age. It includes geometry from the 3rd class onwards.

Syllabuses

The principal points of the syllabus are as follows :—

1st class: counting objects, and numeration and notation ; units and tens ; notation of, and the four operations with, numbers up to 99 ; mental arithmetic ; problems.

2nd class: revision of the previous year's work ; whole numbers up to six digits ; fractions with one-digit numerators and denominators ; the four operations and checking answers ; Portuguese currency ; Roman notation ; mental arithmetic ; problems.

3rd class: revision of the previous year's work ; the four operations with whole numbers and decimals ; units of time ; weights, and measures of length, capacity, area and volume ; measuring instruments, common weights and scales ; mental arithmetic ; problems.

4th class: converting fractions into decimals, and vice-versa ; simplifying, and the four operations with, fractions ; the four operations with non-decimal measures (divisions of time and circumference) ; the metric system and application to measuring ; exercises and problems.

At all levels, every lesson includes some practical work.

History, geography and handwork also provide opportunities of acquiring mathematical skills and knowledge.

Arithmetic is deemed the most important subject after the mother tongue. In the examination coming at the end of the 4th year children must attain a satisfactory standard in arithmetic in order to pass.

AIMS

The object of teaching mathematics in Portugal's primary schools is to develop a child's powers of reasoning and to train him to solve everyday problems.

METHODS

The primary curriculum contains important recommendations as to method. The attention of teachers is drawn to the educational value of certain carefully graded activities. All that the children learn should be grounded in concrete experience, and teachers should check all their work. The purely utilitarian aspects of arithmetic should never be neglected.

Arithmetic calls for the use of teaching materials which include, among other things, cork disks, marbles and some games (clock-games, dominoes, etc.).

Each of the first three classes in the lower primary schools has its own arithmetic textbook. For the 4th class, teachers may choose one or other of the textbooks approved by the Ministry of National Education.

MISCELLANEOUS

Two recent publications on the teaching of mathematics should be mentioned : FARIA and VASCONCELOS's " Como se ensina aritmética " and " Como se ensina a raciocinar en aritmética " (Lisbon).

SALVADOR

From the reply sent by the Ministry of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

In Salvador a subject called *ciencias matemáticas* (mathematical science) is taught in the primary schools, from the 1st class (children of seven years of age) onwards. As a rule six hours a week are devoted to it in the first four classes, and five hours a week thereafter.

Notions of geometry are given in all classes.

SYLLABUSES

The principal items studied are as follows :—

1st class: comparing sizes ; Salvador currency, up to one *colon ;* numeration and notation up to 100 ; the four operations concretely with quantities up to 100 ; measuring exercises with metre, *vara*, yard, litre and bottle ; weighing in pounds and ounces ; concrete study of spheres, cubes, cones, cylinders and prisms.

2nd class: the four operations with whole numbers up to 1,000 ; revision and development of knowledge of weights and measures of length and capacity ; Roman notation up to 100 ; telling the time ; practical study of fractions up to fifths ; revising notions of geometry done the previous year, and concrete study of circumference and circle, squares, rectangles and triangles, and comparison with the figures already known ; areas and perimeters of the figures studied ; plumb-line and level.

3rd class: learning tables in a more systematic way ; telling the time ; Roman notation continued ; revision, through practical use, of weights and measures ; first problems on the use of decimal fractions (up to tenths) ; making out small family budgets ; measuring perimeter of quadrilaterals and triangles ; angles ; converting *varas* and yards into metres, and vice-versa ; drawing a plan of the school ; revision of ordinary fractions ; area of squares and rectangles; converting bottlefuls into litres, and vice-versa ; use of geometrical figures in drawing garden-beds ; problems with the four operations on whole numbers and decimals ; short forms of operations with numbers consisting of a digit followed by noughts ; area of triangles, parallelograms and rhombuses ; constructing angles, triangles and quadrilaterals with compass and protractor ; introduction to scale in constructions.

4th class: revision of work done in the previous class ; making work plans with a budget ; prices of various articles and materials, rise and fall in price ; the metric system ; addition and subtraction with fractions ; perimeter and area of the trapezium ; construction of angles and regular polygons with compass ; drawing a plan of the school to scale ; divisibility ; problems on the four operations ; simple rule of three ; problems with construction ; circle and circumference ; compound numbers ; short forms of the operations.

5th class: revision of previous year's work ; direct and inverse rule of three ; perimeter and area of fields and calculation of their produce ; apothem and area of polygons ; municipal budgets ; plumb-line and level ; constructing solids (prisms and cubes) and calculating their volume ; exercises on checking calculations ; problems on percentage and interest ; constructing cylinders, cones and pyramids ; volumes ; drawing graphs of production, consumption, exports and imports ; statistics.

6th class: revision of previous year's work ; explanation of book-keeping terms " assets ", " liabilities ", " liquid ", " personal " and " current " accounts ; relationships between the various metric units ; synthesis and analysis of numbers ; prime numbers, powers and exponents ; use of terms " owes ", " balance in hand ", " invoice ", " cheque ", " bill of exchange ", " debtor ", " creditor ", " client " ; ratio and proportion, simple and compound rule of three ; percentage ; proportional parts ; averages ; exercises on geometrical drawing ; explanation of terms " debit ", " credit ", " deficit ", " balance ", " to charge ", " to credit ", " to balance " and to open " an account, "simple and double entry" ; Salvador's monetary system ; the national budget ; taxes ; banks ; legal regulations concerning stamps, legal dues etc. ; cash-book, ledger, inventory ; drawing graphs of statistical data.

In all classes, mathematics should be taught on the basis of concrete data. The subject-matter of exercises and problems should always be taken from the environment, and should be connected with children's needs and those of the community. In other words, the subject should be an essentially practical one. The teaching of it, moreover, should not be confined to the periods assigned to it in the time-table, but should also be given on every possible opportunity during other lessons, especially those on natural or social science. There is, indeed, hardly a part of natural science where mathematics are not required, especially if one is seeking to achieve something practical. In dealing with the domesticated animals, for example, a reference to the costs (equipment, feeding stuffs and other expenses) and the returns of stock-raising will be of value.

Mathematics and the mother tongue are the subjects which count most for promotion and in the school-leaving examination.

AIMS

The principal aims of teaching mathematics in Salvador's primary schools are firstly to enable a child to achieve a certain intellectual independence and gain his own true idea of the quantitative aspects of his local and national environment, and secondly to develop his capacity to solve everyday problems.

METHODS

Mathematics having proved the most difficult subject to teach, instructions on method have been issued, with a view to obtaining better results. They may be summarised as follows :—

(a) At primary school level, mathematics should be taught concretely.

(b) The subject should be related to home and community interests and needs.

(c) Classes should be divided into groups, so that account may be taken of individual capacities.

(d) The teacher's attitude should be one of understanding and encouragement, towards even the most minute details of the work his pupils do.

(e) Pupils should not be helped to solve problems unless they quite fail to do so by themselves.

(f) The teacher should provide opportunities for the pupils themselves to ask questions and set problems.

(g) Exercises need not deal with large quantities ; small ones are even to be recommended.

(h) The teacher should make no attempt to standardise the rate of progress in his class ; it is a forlorn hope, given the variety of subjects, above all in mathematics ; each child should advance at his own pace.

(i) Without neglecting the mechanical skills, the teacher should put the greatest emphasis on the framing and solving of problems, and so aim at developing his pupils' mathematical sense.

(j) Teachers should not be discouraged when their pupils give wrong answers, since discovering the cause of mistakes is excellent mathematical training.

For the 1st and 2nd classes, teachers are recommended to use materials costing little or nothing, and consisting of seeds, for example, used matches, and marbles. At more advanced stages, the subject-matter of problems consists of the current prices of articles consumed locally.

Official instructions contain no mention of textbooks.

MISCELLANEOUS

The first draft of a new syllabus suggests that the four operations will not be taught in the 1st class, but only addition and subtraction. Items which are of little or no value as mathematical training or which seem out of keeping with the intellectual level of primary school children, will also be omitted from the syllabus.

Various articles on the teaching of mathematics in primary schools have appeared in the Ministry's journal " Revista del Ministerio de Cultura ".

SWEDEN

From the reply sent by the Ministry of Education and Religion

PLACE OF MATHEMATICS IN THE CURRICULUM

The subjects called *Räkning och Geometri* (arithmetic and geometry) are taught in Sweden from the 1st year (children of seven years of age) of the primary school. Three hours a week are devoted to them in the 1st year, four hours in the 2nd and 3rd years, and five hours in the 4th, 5th, 6th and 7th years.

SYLLABUSES

The main points of the syllabus are as follows :—

1st year : addition and subtraction exercises on quantities up to 20 or 30 ; use of the centimetre, decilitre, hectogram, *öre*, and certain units of time ; the dozen.

2nd year : numeration up to 100, with exercises mainly of addition and subtraction ; measurements in centimetres, decimetres and metres (numbers above 100 may in this case be used) ; decilitre and litre ; hectogram and kilogram ; the *öre* and crown ; units of time.

3rd year : the four operations with whole numbers (one-digit multipliers and divisors) ; mental arithmetic ; common weights and measures, and conversion exercises.

4th year : the four operations with whole numbers ; exercises and problems entailing two or more operations ; mental arithmetic ; area of squares and rectangles ; volume of cubes and rectangular parallelepipeds ; weights, measures and other measures already studied.

5th year : exercises on the four operations ; notions of fractions and their nomenclature ; addition and subtraction with fractions in simple cases (small common denominator) ; multiplication of a fraction by a number, and application in exercises ; decimals ; mental arithmetic ; straight lines, angles, parallelograms, triangles, prisms (drawing, describing and measuring, with simple calculations).

6th year : Arithmetic : graded exercises on the four operations ; a more systematic study of ordinary and decimal fractions ; calculating percentages, and problems on interest, profit and loss, discount, commission and alloys; mental arithmetic. Geometry: circles, polygons, prisms and cylinders.

7th year: Arithmetic: problems on percentage and interest sometimes involving an equation, and the use of tables to solve such problems; mental arithmetic; elementary bookkeeping. Geometry: the ellipse, pyramid, cone and sphere.

The greater part of a lesson is always reserved for individual or group exercises. Mathematical ideas are needed in lessons on the homeland, geography and natural science.

Mathematics is deemed one of the most important subjects in primary schools, and children must attain a certain standard in mathematics and the mother tongue to obtain their primary school-leaving certificate.

AIMS

Introduction to mathematics in Sweden's primary schools aims at giving children a certain knowledge, more especially of the kind which is useful in everyday life.

METHODS

Official instructions are issued on method. They insist that the study of any given question, especially in the lower classes, should begin in a quite concrete way, and that the various subjects in the curriculum should be as closely articulated as possible.

They suggest, further, that there should be a certain sequence in the teaching; concrete, practical exercises should be followed up with work of a purely numerical nature, for retaining what has been studied and acquiring mechanical skills. Any given item should not be forsaken until the children have gained sufficient facility and assurance with regard to it.

Teachers must correct all written work carefully.

Mental arithmetic is considered as extremely important, and exercises in it should be frequent but short (ten to fifteen minutes at a time).

In giving examples or setting problems, teachers should avoid numbers which are too big and fractions which are too small. Ordinary fractions may be taken either before or after decimal fractions.

Any problems set should be similar to those arising naturally in the environment (at school or home, and in commerce and industry), or connected with questions studied in other lessons. Teachers should set gifted children more difficult problems, in greater number.

Children should be accustomed to checking their calculations and to deciding whether their answers seem true.

Volumes and areas to be calculated should as far as possible be those of the immediate surroundings, and the greatest importance should be attached to the setting out of figures. Measurements made in the playground will give an opportunity for exercises in estimating.

In the lower classes, the concrete element takes the form of stones, buttons, draughts, counting sticks, shells and coins. Ball-frames, counting games and various objects with a geometrical form are also used.

In all classes, except at the very beginning in the 1st year, arithmetic textbooks are used. They must meet with the approval of a government committee.

MISCELLANEOUS

Of the publications on the teaching of arithmetic in primary schools, mention should be made of NORDLUND, SORENSEN and WIKBERG's "Arbetssättet i folkskolan" (methods of work in primary schools—Stockholm, 1926), and F. WIGFORSS's "Den grundläggande matematikundervisningen" (bases of the teaching of mathematics—Stockholm, 1944).

SWITZERLAND

From the replies sent by the cantonal Departments of Education

Basel-City

PLACE OF MATHEMATICS IN THE CURRICULUM

A subject called *Rechnen* (reckoning or arithmetic) is taught in the four classes of the Basel-City primary schools. Four hours a week is devoted to it in the 1st and 2nd classes, and five hours a week in the 3rd and 4th.

SYLLABUSES

The essential points in the arithmetic syllabus are as follows :—

1st class: numeration up to 20 ; notions of addition and subtraction ; exercises in rhythmical counting, in chorus, as preparation for multiplication ; comparing sizes ; preparing for written arithmetic.

2nd class: numeration up to 100 ; addition and subtraction with carrying and borrowing ; introduction to multiplication tables ; notions of pair, dozen, week, litre, franc and centime.

3rd class: numeration up to 1,000 ; multiplication, and division with remainder ; weeks and months ; hours, minutes and seconds ; hectolitre and litre ; metre and centimetre ; kilogram.

4th class: numeration up to 100,000 ; written arithmetic ; multiplication and division by two-digit numbers ; numerical dictations ; further work on the metric system.

In the primary school, arithmetic is taught mainly through exercises. Examples should as far as possible be connected with problems arising in the course of studying the other subjects in the curriculum.

AIMS

The mathematical ideas a child learns at the primary school should enable him to grasp and comprehend the quantitative aspects of his environment, and to gain a certain skill and confidence in using numbers.

METHODS

The official syllabus contains some general suggestions to teachers as to method. A child should find his work interesting, and to this end it is above all essential to avoid burdening his mind with superfluous and useless material. Teachers should not give rigid, static lessons, and should be guided in their choice of problems by the children's activities in and out of school, rather than by a book. Great importance is attached to preciseness of expression in arithmetic exercises.

The use of a textbook is not compulsory in either the 1st or 2nd class.

Geneva

PLACE OF MATHEMATICS IN THE CURRICULUM

Introduction to mathematics begins with arithmetic in the 1st class (children of six to seven years of age) of Geneva's primary schools. Five hours a week are devoted to it in the first three classes, four hours in the 4th class, and three hours in the 5th, 6th and 7th classes. From the 5th class onwards, one hour a week is in addition devoted to geometry.

During (optional) pre-school education, educational games play a part in introducing children to mathematics.

SYLLABUSES

The main points of the syllabus are as follows :—

1st class : numeration and notation up to 10 ; exercises on number facts.

2nd class : study of numbers up to 120 ; dozens and hundreds ; addition, sum, total ; subtraction, remainder, difference ; simple problems with at most two operations ; exercises on pairs, dozens, year, franc and centime.

3rd class : study of numbers up to 1,200 ; thousands ; multiplication ; exercises on metres, centimetres, kilograms, half-kilograms, litres and half-litres ; problems with two and three operations ; mental arithmetic with addition, subtraction and multiplication.

4th class : numeration up to 200,000 ; multiplying by 10, 100 and 1,000 ; division ; profit and loss, selling price ; introduction to fractions ; metres, decimetres, centimetres, litres, decilitres, kilograms and hectograms ; problems involving four operations.

5th class : Arithmetic : units, thousands and millions ; exercises with fractions ; tenths, hundredths and thousandths ; the four operations with decimals ; cost price, selling price, profit and loss ; the metric system (length, capacity and weight). Geometry : straight, curved and broken lines ; the point ; constructing and measuring angles ; constructing quadrilaterals and triangles ; scale.

6th class : Arithmetic : hundred-thousands ; revision of the four operations with decimals ; units of area ; averages, approximations, gross weight, load, net weight and wastes. Geometry : rectangular, equilateral, isosceles and other triangles; drawing perpendiculars ; sum of angles ; trapezium ; area of rectangles, squares, triangles, parallelograms and rhombuses ; hexagons, octagons and circles ; length of the circumference ; finding π experimentally ; diameter.

7th class : Arithmetic : Roman numerals ; the four operations with whole numbers, decimals and fractions ; units of volume, gauging ; specific weight ; units of time ; percentages and interest ; finding revenue and capital ; bills, invoices and accounts ; discount. Geometry : bisector, median ; volume of parallelepipeds and cubes ; area of regular polygons and circles ; problems.

In all classes, first importance is given to practical exercises, and data provided by other subjects in the curriculum are used.

Arithmetic and French are the two most important subjects in estimating a pupil's progress.

AIMS

The principal aim of teaching arithmetic is to develop a child's ability to count, which involves the acquisition of speed, confidence and mechanical skills. Elementary geometry should enable him to calculate length, area and volume, and to estimate, compare and measure.

METHODS

The primary curriculum, the " Plan d'Etudes de l'Ecole Primaire " contains suggestions on the teaching of arithmetic and geometry.

In all classes, teaching should be concrete, and children should acquire each new idea through experimenting and making drawings and sketches.

The content of problems should as far as possible be related to a child's interests, and in the nature of experiments the results of which can be easily checked.

Children should be trained by short, frequently recurring exercises to use tables with an almost mechanical precision. Mental arithmetic lessons should also be short and frequently recurring.

So far as geometry is concerned, introductory work should always be based on sense activities.

Mathematical ideas should be learned, especially in the beginning, through games, objects such as counters and counting sticks, cutting out and modelling.

In all classes, teachers make use of textbooks prepared by specialists in collaboration with the inspectors and primary teachers.

For children not yet able to read well, there are illustrated leaflets comprising various problems they can solve by themselves. In the special classes and, in certain cases, ordinary classes, teachers use cards enabling them to individualise their teaching.

MISCELLANEOUS

Two books which have been especially useful in forming teaching methods are Louis GROSGURIN's " Méthodologie de l'arithmétique " (Payot, 1922) and " Méthodologie de la géométrie " (Payot, 1926).

Neuchâtel

PLACE OF MATHEMATICS IN THE CURRICULUM

In the canton of Neuchâtel, introduction to mathematics is given, under the heading of arithmetic and mental arithmetic, from the beginning of compulsory schooling (children of six years of age on 30th April) onwards. Six to eight hours a week is devoted to the subject in boys' classes, and five to six in girls' classes.

From the second class onwards, the arithmetic and mental arithmetic syllabus includes notions of geometry.

SYLLABUSES

By the end of the year, pupils should have learned :—

1st class: the use of the signs +, —, = ; addition with two lines, totals being less than 20 ; subtraction without borrowing.

2nd class: addition with two or more lines, totals not to exceed 100 ; subtraction with borrowing ; multiplication by numbers up to 6 ; the meaning of the terms even, odd, double, half, dozen, half-dozen, metre, litre, franc, square, rectangle, triangle ; mental and written arithmetic on simple problems involving one operation.

3rd class: multiplication table up to 9 × 10; multiplication by two-digit multipliers; division by one-digit divisors, with and without remainder; money; solving simple problems involving one or two operations, in writing; quarter, third, treble; solving simple problems mentally.

4th class: multiplication table; multiplying whole numbers or decimals by 10 and 100; decimal notation to two places; metres and litres, and their multiples and sub-multiples (without conversion exercises); multiplication with whole numbers and decimals; solving simple problems within the limits of the curriculum; the meaning of the terms length, width, height, depth, horizontal, vertical, oblique.

5th class: multiplication table; the "test by 9" of multiplication and division; solving simple problems involving the unitary method, and writing a simple proof; multiples and sub-multiples of the metre, litre and gram; money; multiplying mentally by 10, 100, 1,000, 5, 50, 25 and 20.

6th year: the metric system as far as the units of area; addition and subtraction with vulgar fractions, common denominators being up to 60; interest per annum; writing out an invoice and a simple cash account; calculating the area of squares, rectangles, triangles and, in the case of boys, trapezia; solving everyday problems.

7th year: the whole metric system; calculating interest and discount, length of circumference, volume of cubes and parallelepipeds, and, in the case of boys, the area of circles; application of formulas regarded as means.

Compulsory schooling in Neuchâtel lasts nine years. At all levels, the learning of a new principle should immediately be followed up with an exercise.

Arithmetic may be articulated with other subjects, such as geography, object lessons and handwork.

Written examinations, including written and mental arithmetic, are held once a year throughout the canton, the questions being set by the Department of Education.

AIMS

The aim of teaching arithmetic and mental arithmetic at primary level is to develop mechanical skills and the power to reason.

METHODS

The general principles on which teachers should base their work in arithmetic and mental arithmetic are given and expounded in the infant-school and primary curriculum.

It is recommended above all that arithmetic be taught in a concrete way, i.e., the learning of a new item of knowledge should always go hand-in-hand with a concrete and practical realisation of the new principles involved. Problems should always be related to everyday life and local needs, and be practical and clear.

Teachers also make use of exercises in folding, cutting out, sticking and the like, and of buttons, beads, counting sticks, weights, measures, etc., and, in the first three classes, of educational games based on activity methods.

Arithmetic textbooks are used too, prepared by Neuchâtel teachers who know the needs and abilities of the children.

MISCELLANEOUS

A teachers' committee is preparing arithmetic cards to complete the materials already in use and assist the individualisation of teaching.

The book most employed at the present time on method is TUETEY and GRIZE's " L'arithmétique à l'école primaire " (Guide du maître).

Vaud

PLACE OF MATHEMATICS IN THE CURRICULUM

A first introduction to mathematics is given in the canton of Vaud in the infants class, to children of five to six years of age.

Arithmetic, geometry and bookkeeping then begin at the primary school proper. To the three subjects as a whole four hours a week for boys and three for girls are devoted in the junior section, and five hours a week for boys and four for girls in the intermediate and senior sections. Geometry as such begins in the senior section.

SYLLABUSES

The main points of the syllabus are as follows :—

Infants class: notions of unity and plurality ; broad knowledge of numbers up to 10 ; dividing a whole number into two, four and eight equal parts ; notions of solids, surfaces, lines and points ; analysing and comparing simple figures.

Junior section, 1st class: broad knowledge of numbers up to 20 ; number facts within the range ; concrete and abstract oral exercises on addition and subtraction, with borrowing and carrying ; knowledge of digits and their use in addition and subtraction ; use of the signs +, —, and =.

Junior section, 2nd class: numeration up to 100 ; general study of each ten, and concrete and abstract addition and subtraction exercises in connection with such study ; multiplication and division of a unit number or of whole tens by 2, 4, 8, 10, 5, 3, 6, 9 and 7 ; notions of centimetre, decimetre, metre, franc and centime ; simple estimation in centimetres and decimetres ; concrete exercises and practical questions relating to other subjects in the curriculum or to knowledge gained by experience ; multiplication and division signs.

Inter. section, 1st class: graded concrete and abstract addition and subtraction exercises on numbers with up to three digits ; multiplication and division table up to 10×10 ; multiplication and division by a number less than 10 ; the metre, decimetre and centimetre ; franc and centime ; litre and decilitre ; kilogram and gram.

Inter. section, 2nd class: thousands ; concrete addition and subtraction exercises within the range ; multiplication and division by a one- or two-digit number ; the kilometre and other multiples of the metre ; the hectolitre and other multiples of the litre ; the kilogram and other multiples of the gram ; quintal and metric ton ; multiplying whole numbers by 10, 100 and 1,000 ; decimals (tenths, hundredths and thousandths) ; addition and subtraction with decimals ; multiplication and division of decimals by a whole one- or two-digit number, and by 10, 100 and 1,000.

Inter. section, 3rd year: Roman numerals ; millions ; addition and subtraction within the range ; multiplication by one-, two- or three-digit numbers ; the " test by 9 " ; vulgar fractions, fraction of a whole number ; units of time (day, week, month and year ; day, hour, minute and second) ; the four operations with decimals ; units of area and agrarian measures ; perimeter and area of squares and rectangles ; invoices and small amounts.

Senior section, 1st class: hundred-thousands ; multiplication and division by numbers with more than three digits ; further work on decimals ; units of volume ; relationship between units of volume and of capacity ; vulgar fractions, simplifying, conversion of vulgar fractions into decimals, and vice-versa ; percentage ; bills, invoices, reminders, receipts and expenditures account ; for boys only : reduction series ($^1/_4$, $^1/_5$, $^1/_{10}$ and $^1/_{100}$), angles, squares, rectangles, triangles, rhombuses, trapezia and polygons.

Senior section, 2nd class: Roman numerals ; problems with whole numbers and decimals ; prime numbers, divisibility, and simplifying and amplifying fractions ; common denominators, comparison of fractions, and the four rules with fractions ; unitary method ; calculating percentage and interest ; cost price, estimates, and cash and other accounts with debit and credit entries ; for boys only : circumference, circle, measuring angles, cubes, parallelepipeds, prisms.

Senior section, 3rd class : interest, capital, terms; commercial documents, rebates ; proportional parts, mixtures and alloys ; density ; cost price, inventory, balance sheet, cash and personal accounts ; for boys only : reduction series, surveying, maps, cylinders, pyramids, cones, cubic content of haystacks, dung-heaps, piles of gravel, and wooden balls, elementary surveying exercises.

At all levels, textbooks contain practical exercises.

Geography, science, and work in the open air all have connections with the introduction to mathematics.

AIMS

Through studying arithmetic and geometry children should learn to calculate, and to solve simple everyday problems, and at the same time develop their powers of attention, judgment and reasoning, and become orderly and accurate.

METHODS

Suggestions to teachers are made in the official curriculum and general instructions for infant and primary schools.

Teachers are recommended to base their work on the following principles :—

a) Every good lesson stems from an intuitive source.

b) Rules are not given by teachers, but found by the children, by means of well chosen concrete and abstract exercises.

c) Mental arithmetic is always useful as preparation for written work. Special procedures suitable merely for written work make their appearance only from the intermediate section onwards.

d) At all levels, arithmetic must call for the use of intelligence, and not simply be the mechanical application of given rules or principles. Children should be given frequent practice in simplifying as much as possible.

e) Arithmetic should as far as possible be articulated with other subjects in the curriculum.

f) There should be a quite special relationship between arithmetic and handwork—folding, cutting out, making geometrical solids, and estimating and measuring in the playground. Care should be taken, however, that such activities do not retard learning, but on the contrary serve to clarify teaching and make it more precise, and develop the children's arithmetical ability.

All that is concrete within a child's environment may serve as teaching material.

Approved textbooks exist, written by teachers or inspectors.

Zurich

Syllabuses

The main points in the primary arithmetic syllabus for the canton of Zurich are as follows :—

1st class: counting rhythmically forwards and backwards; number facts up to 20 ; digits.

2nd class: numeration up to 100 ; addition and subtraction of two-digit numbers ; multiplication and division by one-digit numbers ; money, metre, decimetre, centimetre ; exercises.

3rd class: numeration up to 1,000 ; number facts within the range ; addition and subtraction within the range ; multiplication and division of tens and hundreds by one-digit numbers ; kilometre, hectolitre, litre, hour, minute, second ; exercises.

4th class: numeration up to 10,000 ; the four operations within the range ; calculating quantities expressed in two orders of units.

5th class: numeration up to 100,000 ; exercises on measurements expressed in two or more orders of units ; fractions, addition and subtraction of fractions with the same denominator ; multiplication and division of fractions by whole numbers.

6th class: numeration up to 1,000,000 ; addition and subtraction of fractions ; decimals, addition, subtraction and multiplication ; percentage.

In all classes, practical exercises should be frequently given.

Aims

It is stated in the official instructions that the arithmetic syllabus aims at enabling a child to form concepts of number, acquire the fundamental arithmetical skills, develop his power of reasoning, and apply his knowledge to solving problems arising in everyday life.

Methods

The syllabus states that in order to achieve the above aims, it is necessary to give frequent practice in the fundamental operations, and that special attention should be given to mental arithmetic, the ground of all arithmetic.

SYRIA

From the reply sent by the Ministry of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

The first introduction to mathematics in Syria is given at the nursery-infant school, to children from three to six years of age. At the primary school, a subject first called " reckoning " and later " arithmetic ", is taught in all classes, for five hours per week. Notions of geometry are included with it from the second class onwards.

SYLLABUSES

The main questions dealt with in each class are as follows :—

1st class : numeration and notation up to 100 ; mental arithmetic ; addition and subtraction up to 100 ; exercises, orally and in writing ; multiplication and division by 2, 3 and 4.

2nd class : Arithmetic : revision of the 1st year syllabus ; numeration and notation up to 10,000 ; the metre and its multiples ; addition and multiplication tables ; mental arithmetic with numbers up to 100 ; written work with numbers up to 10,000 (divisors of only one significant figure) ; simple problems. Geometry : lines, measuring lengths ; angles, triangles, squares, rectangles and circles.

3rd class : Arithmetic : numeration and notation up to 1,000,000 ; the four operations (divisors up to three significant figures) ; the metre and gram, and their multiples, and the litre ; decimals. Geometry : squares, rectangles, triangles and parallelograms ; notions of measuring areas by means of unit squares.

4th class : Arithmetic : revision of work done the previous year ; exercises and problems ; units of area (square metre and its multiples and sub-multiples, are, hectare and centiare) ; areas of rectangles, squares, parallelograms and rhombuses ; divisibility by 1, 2, 3, 5 and 9 ; decimal and vulgar fractions, and operations with them ; the rule of three. Geometry : the circle, sexagesimal division, measurement of angles with protractor ; scale drawing.

5th class : Arithmetic : problems on the simple and compound rule of three ; percentages, simple interest, discount ; proportional parts ; speeds ; averages ; Syrian, Egyptian, Iraki and Palestinian currencies. Geometry : length of the circumference ; area of parallelograms, trapezia, regular polygons and circles ; surface area of prisms and cylinders ; volume of rectangular parallelepipeds, prisms and cylinders ; construction of inscribed squares, hexagons and equilateral triangles ; drawing side elevation of cubes and parallelepipeds.

In all classes, practical exercises play an important part in the teaching of mathematics. Handwork and drawing lessons offer opportunities for a clearer understanding of certain notions of geometry.

In yearly and school leaving examinations, the greatest importance is attached to the marks obtained in arithmetic.

AIMS

Introduction to mathematics at primary level should teach a child the technique of arithmetic, and aid in forming his power to reflect and reason.

METHODS

The methods used in Syria are based on the mental growth and development of the children. Teaching begins with concrete activities, and leads on gradually towards deductive processes. The concrete element is represented by stones, ball-frames, seeds, and various objects made of wood or cardboard.

Textbooks are not used in the primary school. In the top classes, pupils keep notebooks.

THAILAND

From the reply sent by the Ministry of Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Number and arithmetic in Thailand are taught along with play in the kindergartens, which children attend from three-and-a-half to six years of age. In primary schools, three hours per week in the first and second grades and four in the third and fourth are devoted to the subject called arithmetic and accountancy, which involves measurements using local, English and metric units of length and area.

SYLLABUSES

The matters dealt with are addition, subtraction, multiplication, division, weights and measures, currencies, simple problems on the rule of three, and easy accounts.

Problems must be related to local conditions and environment, and be of practical use to the children.

Arithmetic counts for about 15% of the total marks at an annual examination.

METHODS

There are no definite instructions as to methods, these being taught at the training colleges.

Models, real objects or pictures are used as teaching aids.

Arithmetic textbooks are not compulsory. They are prepared by private individuals, and then examined and approved by the Ministry of Education.

MISCELLANEOUS

The elementary syllabus has just been revised.

Teaching methods are adopted from the West and therefore do not depart in any distinctive way from what is already known to the world in general.

TURKEY

From the reply sent by the Ministry of National Education

PLACE OF MATHEMATICS IN THE CURRICULUM

A subject called " mathematics " is taught in all classes of Turkish primary schools. Four hours a week is devoted to it in the first four classes, and five hours a week in the fifth class.

No special approach to geometry is envisaged in the curriculum. Notions of it are taught in lessons, in the lower classes, on *Hayat Bilgisi* (knowledge of life).

SYLLABUSES

The principal questions dealt with at primary level are as follows :—

Arithmetic : the four operations with whole and decimal numbers and fractions ; percentages, interest and discount ; measures and graphs.

Geometry : solids, surfaces, lines and points ; angles, triangles, quadrilaterals, squares, circles, cubes, prisms, cones, cylinders and spheres.

These various points are dealt with in each primary class, but in a form suited to the intellectual level of the children. Practical exercises are always of great importance in the teaching of mathematics, and on occasion science and geography lessons also contribute.

In the class and school leaving examinations, all subjects are of equal importance.

AIMS

At primary level, children should acquire knowledge and skills, and the power to turn them to good account. They should also form habits of order and economy in their work.

METHODS

The official curriculum not only indicates what is to be taught, but also contains instructions on method. It favours the use of activity methods ; these imply a certain adaptation of teaching to time and place.

Textbooks are used, which are in harmony with the aims and methods envisaged in official instructions.

UNION OF SOUTH AFRICA

From the reply sent by the National Bureau of Educational and Social Research, Union Department of Education

Cape of Good Hope

Place of Mathematics in the Curriculum

Arithmetic is taught from the kindergarten and the transition class onwards. The time devoted to the subject is two-and-a-half to three hours a week in the kindergarten and transition class, two-and-three-quarter hours a week in standards I and II, three-and-a-half hours in standards III and IV and three-and-a-quarter hours in standards V and VI.

Geometry is not taught as such in the primary school, but certain aspects of geometry, such as simple questions on mensuration and geometrical drawing, are given in the top classes.

Syllabuses

In brief, the matters dealt with under the heading of arithmetic are as follows :—

Kindergarten and transition class: numeration to 100 ; a thorough study of numbers up to 20 ; addition and subtraction within the range of the numbers 0 to 20 ; counting in twos, threes, fours and fives ; the signs +, —, = ; practical acquaintance with the coins 1d., 3d., 6d., 1s. ; the application of these principles in simple exercises.

Standard I: revision of previous work ; numeration and notation up to 100 ; regular oral drill in the addition and the subtraction of numbers 0 to 9, to and from numbers within the range 0 to 30 ; counting in twos, threes, etc., up to nines ; written addition of numbers of not more than two digits, the sum not to exceed 100 ; written subtraction of numbers of one and two digits within the range 0 to 99 ; the building up and learning of multiplication tables to 12×6, and of division tables to 72÷6 ; multiplication and division (without remainder) by numbers up to 6, within the range 0 to 100 ; the signs +, —, ×, ÷ and = ; practical acquaintance with coins ½d., 1d., 3d., 6d., 1s., 2s., 2s. 6d. ; practical acquaintance with half and quarter by means of folding, measuring and/or division; the application of these principles in simple exercises.

Standard II: revision of previous work; numeration and notation up to 1,000; place values and the use of 0 as a digit; regular oral drill in the addition and subtraction of numbers up to 9, to and from numbers within the range 0 to 60; addition of numbers of not more than three digits, with a total not exceeding 1,000; subtraction of numbers of one, two or three digits within the range 0 to 999; the building up and learning of multiplication tables to 12×12, and of division tables to 144÷12; multiplication by two-digit numbers, products not to exceed 1,000; division of numbers not exceeding 1,000 by one-digit numbers; simple addition and subtraction of money: shillings and pence with a total of not more than ten shillings; a practical acquaintance with the fractions $^1/_2$, $^1/_4$, $^1/_8$, $^1/_3$, $^1/_6$, $^1/_{12}$; a practical acquaintance with weights and measures (yard, foot, inch; gallon, pint; pound, ounce; week, day, hour, minute) and knowledge of the relative tables; reading time from a watch; Roman notation up to 12; the application of these principles in simple exercises.

Standard III: revision of work previously done; numeration and notation up to 100,000, with special attention to place value; regular oral drill in the addition and subtraction of numbers up to 9, to and from numbers within the range 0 to 99; addition and subtraction within the range of the numbers 0 to 10,000; thorough revision of the multiplication tables to 12×12, and the division tables to 144÷12; the learning of the multiplication and the division table of 20, to 12×20 and 240÷20; multiplication by numbers of one, two or three digits, and division by numbers of one or two digits; addition and subtraction, and multiplication and division by numbers up to 12, of amounts not exceeding £10; simple purchasing transactions of not more than four items, including the calculation of change; the four basic operations with pounds and ounces, yards, feet and inches, gallons, quarts and pints; knowledge of the table of time (year, month, week, day, hour, minute, second) and of the number of days in the various months of the year; a practical acquaintance with the fractions $^1/_2$, $^1/_4$, $^1/_8$, $^1/_3$, $^1/_6$, $^1/_{12}$, $^1/_5$, $^1/_{10}$; the application of these principles in simple exercises.

Standard IV: revision of work previously done; numeration and notation up to 1,000,000, with special attention to place value; further exercises in the four basic operations applied to numbers and to money, including multiplication and division by numbers of four digits; simple purchasing transactions; rapid calculation by short methods; the more important fractional parts of £1 (the price of items should reflect actual conditions); the four basic operations applied to tons, cwts, pounds and ounces, miles, yards, feet and inches, gallons, bottles, quarts and pints, years, months, weeks, days, hours, minutes and seconds (other measures of capacity which are used locally, such as muid, bag, bushel and bucket, should be noted, but no written exercises should be set on them); the perimeter of rectangular figures; the concept of area, general practical acquaintance with surface measure (square yard, square foot, square inch and tables); addition and subtraction of vulgar fractions, multiplication and division of vulgar fractions by whole numbers (the denominators being limited to 2, 3, 4, 5, 6, 8) ; tests for divisibility by 2, 3, 4, 5, 10 ; the application of these principles in simple exercises.

Standard V: revision of work previously done ; introduction to decimal fractions with special attention to place value ; ratio and simple proportion with easy exercises ; simple exercises in percentages, with special attention to the fact that a percentage is a fraction with 100 as denominator ; calculation of rectangular areas (use of the following surface measures : square yard, square foot, square inch, acre, morgen) ; the concept of volume, practical acquaintance with cubic inch, cubic foot, cubic yard, tables ; calculation of simple averages ; further purchasing transactions ; the four basic operations applied to time, content, weight, length, surface and cubic measure ; application of the four basic operations to vulgar fractions, including multiplication and division of fractions by fractions (denominators being limited to 2, 3, 4, 5, 6, 8, 9, 10, 12, 20, 100) ; the application of these principles in simple exercises.

Standard VI: revision of previous work ; further application of the four basic operations to vulgar fractions and decimal fractions ; further exercises in ratio and simple proportion ; percentages, interest (excluding the calculation of capital, time, and rate of interest), cash discount, commission (exercises being limited to processes applying to everyday life) ; practical asquaintance with the drawing of statistical graphs ; acquaintance with the nature of angles ; practical work in order to determine the relation between the areas of rectangles and right-angled triangles of equal altitude, and by deduction to determine the method for finding the area of any triangle ; reading data from scale drawings ; more advanced exercises of a practical nature with rectangular surfaces ; simple calculations in connection with capacity and volume (rectangular figures only) ; more advanced exercises with weights and measures (calculations being limited to denominations which reflect actual conditions) ; the application of these principles in simple exercises.

As regards practical work, the introductory remarks to the arithmetic syllabus for the primary school state that " All principles should be applied to practical conditions arising out of the experiences of the pupils. "

Reference is made to mathematics in subjects such as geography, needlework and woodwork.

Arithmetic is one of the three decisive subjects for ascertaining whether a pupil should be promoted or not.

AIMS

In the kindergarten and the transition class, teaching should be of such a nature as to lead the pupils gradually, by means of concrete examples, to an appreciation of the abstract ideas of number suited to their age.

In standards I and II greater importance should be attached to neatness and accuracy than to speed.

From standard III onwards, speed, in addition to accuracy and neatness, must gradually receive more attention.

From standard IV onwards, in addition to the emphasis upon speed, neatness and accuracy in mechanical work, importance should be attached to logical statement.

METHODS

Prescriptions concerning the teaching of arithmetic are given in the syllabus. Their leading principles are as follows :—

" Regular oral as well as written drill exercises, judiciously selected, should be given throughout the course, in order to clarify and render mechanical, the various arithmetic processes.

" All preliminary principles should be thoroughly revised before new principles are tackled.

" Where possible, new principles should be explained by demonstration with concrete examples.

" Whenever material is dealt with, e.g., taxes, insurance, etc., which is beyond their immediate experience, steps should be taken to ensure that the pupils have a thorough understanding thereof.

" No exercise requiring long and complicated calculations should be set.

" The pupils should be trained a) to judge by estimating or otherwise whether their answers to sums are within the limits of possibility and b) to test the answers of their written work.

" Where it may facilitate the work, the use of algebraic methods should be encouraged, but not made compulsory.

" Individual work should be encouraged.

" Pupils should be trained to acquire such a speed as their particular stage of development will allow ; in so doing they will learn to concentrate better and to attain a higher degree of accuracy than is possible under other circumstances.

" In all standards, stress should be laid on systematic arrangement.

" Calculations connected with a sum should as far as possible form an integral part of the sum itself. Where, however, a working column is required, stress should be laid on neatness and arrangement. "

In the initial stages the building up of number concepts is done by means of sticks, counters, dominoes, the abacus, etc., and any other suitable aids for practical demonstration.

As regards books, the Education Department selects three series of them from which the schools have a free choice.

MISCELLANEOUS

A committee appointed by the Education Department to investigate the teaching of arithmetic in primary and secondary schools presented its report in 1947. As a result of this investigation the arithmetic syllabus for the primary school has been revised.

Natal

PLACE OF MATHEMATICS IN THE CURRICULUM

Children are expected to be in possession of a fair foundation of arithmetical knowledge when they come to standard I of the primary school, at which point arithmetic proper begins. From standard I to standard IV, three-and-three-quarter hours a week are given to the subject, and in standards V and VI five hours a week.

Geometry is not included in the primary curriculum.

SYLLABUSES

Under the heading of arithmetic the following matters are dealt with :—

Standard I : Arabic notation within the range 0-9999 ; Roman numerals up to 12 ; counting forward and backward in integers by twos, threes, fours, fives, sixes and tens ; counting in inches and pence to express a) lengths up to 2 feet in feet and inches, and b) sums up to 2 shillings in shillings and pence ; wholes, halves and quarters with the ruler ; clock-face, the hours, half hours and quarter hours ; dozen and half-dozen ; additions up to four rows of three digits, subtractions up to three-digit rows, multiplications and divisions up to three digits by 2, 3, 4, 5, 6 ; simple shopping transactions, coins in common use, giving change.

Standard II: Arabic system of notation within the range 0-99,999 ; Roman numerals up to 100 ; counting forward and backward in integers by twos, threes, fours (up to tens) ; counting in inches and pence to express a) lengths in feet and inches up to 4 feet, and b) sums in shillings and pence up to 4 shillings ; halves, quarters, eighths, thirds, sixths with ruler ; clock-face in five-minute intervals ; score and gross ; additions up to five rows of five digits, subtractions up to five-digit rows ; multiplications up to five digits by 7, 8, 9, 10, 11 and 12, and of three digits by two digits ; divisions up to four digits by 7, 8, 9, 10, 11 and 12 ; simple shopping transactions, coins in common use, giving change in pounds, shillings, pence and farthings ; reduction up and down of measures of length (yard, foot, inch), of capacity (gallon, quart, pint) and of time (day, hour, minute) ; introduction to halves, quarters and eighths by measurement and diagrams.

Standard III: Arabic notation within the ranges 0-1,000,000 ; Roman numerals up to 1,000 ; counting forwards and backwards by twos up to twelves ; clock-face in minute intervals, the calendar ; the four rules with simple numbers and fractions (halves, quarters, eighths), L.C.M. by inspection ; multiplication and division of amounts of money by 10, 11, 12 ; simple shopping transactions and calculation of change ; addition, subtraction, multiplication, division and reduction up and down of weights and measures (mile, furlong, chain, yard, foot, inch ; English ton, English hundredweight, quarter, stone, pound, ounce, Union or short ton, Union cental ; quarter, bushel, peck, gallon, quart, pint ; year, month, week, day, hour, minute, second).

Standard IV: counting forwards and backwards by integers up to twelves, by simple mixed numbers and by tenths ; prime and composite numbers, factors, rules of divisibility treated simply ; multiplication and division of amounts of money by numbers greater than 12 ; mile, furlong, pole or perch, yard ; square mile, acre, square yard, square foot, square inch, rood, square poles or perches, morgen ; H.C.F. and L.C.M. by factors ; the four rules with fractions (denominator not greater than 16, limited to two terms), reduction to lowest terms ; four rules with decimals (not more than 3 decimal places) ; conversion of decimals to fractions and vice-versa ; rectangle and square.

Standard V: revision of work of previous standards ; cube, rectangular prism ; proportion by method of unity and of equal fractions ; proportional parts ; averages ; meaning of percentages and relation to fractions and decimals, application to everyday transactions.

Standard VI: constant revision of the work previously done with strong emphasis on speed and accuracy ; rectangle, parallelogram, trapezium, triangle, circle ; the right-angled triangle preceded by lessons on square root; bills, percentages, simple interest, ordinary discount, profit and loss, and examples dealing with application to such topics as rates and taxes, commission, savings bank, etc.

In all classes, no new branch of primary school arithmetic should be introduced until some practical problem has convinced the pupil of its utility. Much practice with abstract numbers will be necessary, but the need for such practice must be felt by the pupil, and this need should be shown by the consideration of some concrete problem within the range of the pupils' interests and experience.

Arithmetic is one of the three decisive subjects, for ascertaining whether a pupil should be promoted or not.

AIMS

The teaching of arithmetic in the primary school should :—

a) interest a child in numbers as an instrument for dealing with problems of everyday life ;

b) develop his ability to bring number to bear upon problems of everyday life ;

c) make him understand the rules and processes of numerical computations used in the solution of such problems ;

d) make him thoroughly familiar with the elementary tables used in such computations and ready in the application of those tables ;

e) afford a basis for a possible wider study of mathematics ; and

f) foster appreciation of economy of time and effort, and of how neatness of arrangement helps such economy.

In the first four standards, the teaching should aim at giving a pupil :—

a) accuracy and readiness in the operations of addition, subtraction, multiplication and division as performed with integers, with simple vulgar fractions, and with easy decimal fractions ;

b) ability to employ these operations in simple questions dealing with the money, weights and measures in daily use in his environment ; and

c) an active and accurate oral knowledge of the elementary tables of addition and multiplication, direct and inverted, which are essential to the performance of the above operations, and an acquaintance with the more well-known and effective methods of shortening calculation.

METHODS

Official suggestions concerning method are given in the " Arithmetic Syllabus for Use in Government and Government-Aided Primary Schools ", the most important of which run as follows :—

" Stress should be laid upon accurate computation and orderly arrangement. Problems should generally be attempted only after the mechanical work has been thoroughly mastered. "

" Where possible, pupils should be trained to obtain mentally approximate answers to questions and compare these with their final results. "

" Oral work... should embrace daily exercises on the bonds, and preliminary drill on the topic for the written lesson. "

" The period of educational life from standards I to IV is normally the stage when drill methods are most effective and when lifelong habits may best be formed. These points should be borne in mind by teachers of these standards, and they should make every effort to see that the elementary tables are then thoroughly acquired and that ideals of neatness are constantly incalculated by model and by correction. "

" The great secret in arithmetical progress is gradation of exercises. Gradation implies the provision of a set of easy steps to a higher level ; the steps must lead to a definite end, and it must be easy to pass from one to the next. It may fairly be compared with the increase in railway efficiency caused by diminishing gradients ; the journey is made in shorter time though the distance has been made longer. "

" Correctness first, then speed, is the ideal in arithmetic. "

" The teacher's blackboard work must be as perfect a model as he can make it. Pupils are strongly influenced by the blackboard work which they see in front of them. The arrangement of every written exercise should be a matter of careful study. "

In the initial stages the building up of number concepts is done by means of any suitable aids for practical demonstration.

As regards textbooks, the syllabus states : " The textbook must be used with wisdom. It may be possible for some of the very able pupils to work through every example in the book ; but as a rule, the average pupil will not be able to do this, the weak pupil certainly not. It will, therefore, be advisable to recognise variation of ability by exacting from each pupil an amount of exertion proportioned to his powers. "

MISCELLANEOUS

A new syllabus is being introduced.

Orange Free State

PLACE OF MATHEMATICS IN THE CURRICULUM

In all classes of the primary school, five periods a week are allocated to " arithmetic ". In the higher classes, the subject includes certain aspects of geometry.

SYLLABUSES

The matters taught as arithmetic are in brief :—

Grades I and II (ages 6 and 7) : synthesis and analysis of numbers up to 30.

Standard I: addition and subtraction, multiplication and division by means of the multiplication tables.

Standard II: numeration up to six digits ; easy multiplication and division by numbers up to 12 ; addition and subtraction of pence and shillings ; memorising certain tables of length and time.

Standard III: the four fundamental rules ; simple exercises in reduction based on tables of weight, length and time ; the four fundamental rules applied to money.

Standard IV: the four fundamental rules applied to tables of money, time, length, square and cubic measure, capacity and weight ; simple proportion ; easy fractions ; areas of rectangles.

Standard V: compound proportion ; the four fundamental rules applied to vulgar and decimal fractions ; L.C.M. and H.C.F. ; areas and volumes of rectangular bodies.

Standard VI: percentages, simple interest, averages ; proportional parts ; simple profit and loss ; areas of triangles and circles, and volumes of cylinders and prisms ; square root by factors ; the metric system ; simple exercises on municipal and government taxes.

In all classes, practical work is introduced as far as possible to illustrate theoretical work.

Arithmetic is one of the three decisive subjects, for ascertaining whether a pupil should be promoted or not.

METHODS

Schools are instructed to pay special attention to the mechanisation of the four fundamental rules in the lower primary classes. It is understood that oral and practical work is to be regarded as the basis of all instruction and continuously employed.

In the initial stages the building of number concepts is done by means of sticks, counters, dominoes, the abacus, etc.

Books are not prescribed but they are in general use. These books are prepared for publishers by authors who are experienced teachers as a rule, and are written to conform to the school syllabuses prescribed by the Education Department. Only the books which have the full approval of the Department are allowed.

MISCELLANEOUS

The chief modification has been in the subject matter rather than the actual teaching. The tendency is to discard useless lumber and to put the emphasis on the practical figuring demanded by business and life.

Transvaal

PLACE OF MATHEMATICS IN THE CURRICULUM

The time-table should make provision for an arithmetic lesson daily, except where the organisation of the school makes this undesirable. Generally, five periods totalling three to four hours a week are devoted to " arithmetic " in primary schools. Geometry is not referred to as such.

SYLLABUSES

The outline of mathematics contained in the curriculum includes :—

Grade I: analysis and synthesis of number up to 10 ; counting up to 30 ; addition and subtraction (oral and written) and multiplication and division (oral only) within the range ; the use of the signs +, — and = ; recognition of the coins of 1d., 3d., and 6d. and treatment of equivalence with regard to them.

Grade II: detailed analysis and synthesis of numbers up to 20 ; general knowledge of numbers up to 100 ; counting by twos, fives and tens forwards and backwards ; doubling and halving (results not to exceed 20) ; formation of multiplication and division tables up to 20 ; introduction of the × and ÷ signs ; oral money sums and easy shopping sums ; practical measurement in feet, ignoring fractional parts.

Standard I: treatment of number generally up to 100 ; tables of 2, 3, 4, 5, 6, 10, 11, 12 from the aspect of both multiplication and division, maximum product 100; practical measurement, ignoring fractional parts, in yards, feet and inches as separate units; estimation; exercises with 1 lb, $^1/_2$ lb and $^1/_4$ lb; recognition of the coins of $^1/_4$d., $^1/_2$d., 1d., 3d., 6d., 1s., 2s., and 2s. 6d., equivalence, easy addition of shillings and pence; hours, half-hours and quarter-hours; Roman figures up to 12; exercises in the calculation of halves and quarters of numbers, recognition of the forms $^1/_2$ and $^1/_4$.

Standard II: numbers to 1,000, place values within the range, tables to 12×12; addition and subtraction as applied to £. s. d., shopping and the giving of change; multiplication by two-digit numbers within the range and by 10 and 100 at sight; division by numbers not greater than 12, and by 10 and 100, at sight; cwts and lbs; gallons, quarts and pints, gallons and bottles; addition and subtraction of yards, feet and inches; practical measurement in inches, using the $^1/_2$, $^1/_4$, $^1/_8$ and $^1/_{10}$ fractions of an inch up to 1 foot; estimation of lengths, distances and weights within the children's experience; dozen and gross; $^1/_2$, $^1/_4$, $^1/_8$, $^1/_3$, $^1/_6$ and $^1/_{10}$ of numbers within the range; reading of clock to one minute; the principle of conversion in all tables learned so far.

Standard III: general treatment of integral numbers within practical limits (normally numbers dealt with should not exceed 10,000), place values; tables of 16 and 20 up to 10-times the unit; multiplication and division of integral numbers within the range; the four rules as applied to tons, cwts, lbs and ozs, to gallons, bottles, quarts and pints, to miles and yards, to £. s. d. (multipliers and divisors of not more than two digits); the short method by the dozens rule should be stressed (e.g., $3^1/_2$ d. each=3s. 6d. a dozen, and vice-versa); continued practice in estimating distances, weights and capacity, and checking by measurement wherever practicable; day, hour, minute and second, month, week and day, the four rules in these; year, leap year; number of days in each month; the term "miles per hour", and very simple exercises within practical limits to clarify the meaning of this expression; meaning of the terms denominator and numerator, equivalent fractions; exercises in addition and subtraction of vulgar fractions with denominators 2, 4, 8, 16, or 3, 6, 12, or 5, 10, etc.; conversions in money, weights and measures learnt in this and previous standards (conversion should be closely related to its use in practical life and should not include more than three consecutive units).

Standard IV: integral numbers and decimals not smaller than 0.001, place values; to tables already learnt in previous standards add square yard, square foot and square inch, muid or bag, bucket and aliquot parts of the £; fractions of quantities, four rules with vulgar fractions (to be done separately; exercises in addition and subtraction should be restricted to those in which the common denominator can be found by inspection); decimal notation (introduced practically with the ruler, thermometer, etc.), conversion of easy vulgar fractions to decimals, and vice-versa; the four rules with decimals, multipliers and divisors being whole numbers not exceeding 12; oral calculation of 5, 10, 20, 25, 75, 100 and 150 per cent of exact hundreds and other suitable quantities such as 10 per cent of 40, or 25 per cent of 12; simple proportion (direct only) by the method of unity; practical exercises in measuring and finding areas, e.g., page of book, floor of room, quadrangle, etc., perimeters of rectangular figures; estimation of distances, weights and capacity; drawing up and calculating invoices or statements, calculations being done mentally as far as possible.

Standard V: aliquot parts of the £ and shilling, four rules; Cape foot, Cape rood, morgen, Cape square rood, acre, cubic yard, cubic foot and cubic inch; relationship between Cape foot and English foot, and simple conversions of one to the other; elementary treatment of L.C.M.; extension of treatment of vulgar and decimal fractions (complex fractions being omitted except in so far as they enter into practical examples); continuation of work in percentages, relation between percentages, decimal and vulgar fractions, with application to everyday transactions; simple proportion, direct and indirect; areas of figures composed of rectangles and of figures involving the addition and subtraction of rectangular areas, practical exercises in the calculation of costs of painting surfaces, asphalting and paving paths, cost of glazing, etc.; estimation of distances, weights and capacity; simple calculations of volumes of rectangular solids, exercises involving costs (cost of gravelling giving the cost per cubic yard); short methods of calculation; continuation of invoices and statements related to practical life, utilising all arithmetic taught up to this standard; general knowledge of, and easy exercises in, transactions relating to shops and farming, the post office (stamps, postal and money orders where the poundage and commission are given, telegrams, Union Loan Certificates, etc.), railways (costs of consignments and railfares at given rates), costs of motoring, road transport, taxi fares; reading of times taken, and distances travelled, from railway and other time-tables.

In all classes, practical work is introduced as far as possible to illustrate theoretical work. Imaginary problems that have no direct relation to practical life, must be avoided. Examples must be taken from actual situations, and should not be complicated.

Mathematics is introduced incidentally in connection with drawing in subjects such as art and crafts and nature study.

Arithmetic is one of the three decisive subjects, for ascertaining whether a pupil should be promoted or not.

METHODS

Official suggestions concerning method are made in the " Suggested Syllabuses for Grades-Standard VIII " published by the Transvaal Education Department.

Every school must draw up its own scheme, and it is the duty of the principal to ensure that it is properly graded and coordinated so that there will be continuity and regular progress. Each class teacher should be acquainted with the requirements of the school's scheme as a whole, and must have a thorough knowledge of the requirements of the schemes of the years preceding and following her own standard. She should realise that she is a link in the chain, the strength of which depends on the strength of its weakest link. The scheme must be adapted to the requirements and needs of the environment and must be drawn up in detail.

Every arithmetic lesson should be preceded by oral exercises. These should bear on the written work, namely on the particular point that is being dealt with. Oral and written work should supplement each other. In the grades about two-thirds of the time available should be devoted to oral work, in standards I and II about half the time, and in standards III to V about one-third of the time.

It is irksome for a talented pupil, for the sake of a few weaklings in the class, to have to sit and listen continually to explanations and elucidations of some point or other that he already understands fully. He should be expected to do more work and more advanced work. In large classes a teacher may make use of proficient pupils to help the weaker ones.

It is obvious that concrete devices should, wherever necessary, be made use of to illustrate fundamentals. In every classroom there should be a variety of such devices as bear on the work. It is recommended that in every classroom used by the grades, as many as possible of the following be employed : the abacus, figures on cardboard to serve as models, representations of objects on cardboard with the corresponding figures, domino cards or actual domino pieces, a variety of things that can be handled by the pupils, such as small blocks of different sizes or colours, marbles, acorns, toys, plasticine models of pupils' own design, push carts, etc., flash cards, properly numbered cards with sums that are graded progressively, cardboard coins.

In certain classes there should be, among others, the following resources : a bottle, a pint bottle, a quart bottle, a gallon measure ; laths of lengths 6 inches, 1 foot, 1 yard ; weights of 1 oz., 2 ozs, ½ lb., 1 lb., 5 lb. ; cardboard to indicate square measure ; cubes of different volumes, an inch cube, a rectangular block of wood or cardboard.

A good many of these teaching aids can be made at little expense and with slight trouble by the teacher.

The textbook should be used judiciously and should not be followed slavishly, either as regards content or sequence.

No single textbook can possibly serve the needs of every school. It is accordingly expected that the class teacher will draw up supplementary exercises that will meet the special needs of the neighbourhood.

The use of a suitable textbook by every single pupil of the class is advocated, because too much time is taken up when teachers have to copy exercises on the blackboard. Sets of textbooks are obtainable that provide for two groups of different ability.

MISCELLANEOUS

Amendments and improvements in the teaching of arithmetic are introduced whenever necessary ; some have been made recently.

UNITED KINGDOM

England and Wales

From the reply sent by the Ministry of Education

Place of Mathematics in the Curriculum

At present most infant schools include some formal number teaching at five-and-a-half years, and many begin it immediately after the nursery stage at five, although there is a strong movement towards postponing anything but incidental teaching of number for most children until the end of or late in the infant stage (i.e., until seven years of age).

In infant schools the work in mathematics is almost invariably referred to as " number ", though it is recognised that it may include experience of a spatial kind.

In junior schools it is still common to find the term " arithmetic " and sometimes for boys " geometry ". There is a growing movement to think of the work as elementary mathematics, though this has not yet affected the nomenclature.

Where periods are set aside for number work in a primary school it is usual to find one period per day. In schools of a very formal kind, there may be additional short supplementary periods in the afternoons. An increasing number of schools have informal programmes in which individuals or groups within a class are occupied in a variety of ways, some of which may involve number, in a given section of the time-table, e.g., for the whole or the major part of the morning.

It has been traditional to give boys ruler drawing and to call it geometry. Where this has prevailed from seven years of age the mathematical course as a whole, especially for girls, has suffered.

In most progressive schools it is recognised that representational work is an essential mathematical experience and the increasing use of measurement in the arithmetic lessons is preparing the ground for a much more realistic approach to mathematics for young children. It is still true, however, to say that mathematical teaching from seven to eleven years of age in the majority of schools is dominated by the teaching of mere reckoning.

SYLLABUSES

The idea that children of a given age should be taught this or that stage of arithmetic is giving place to a conception of the syllabus based on the maturation of the individual and the relevance of what is taught to the environment and interests of the children. There is, however, a selection examination for the secondary schools at 11+, which in most areas results in pressure for most children of average or more than average ability to concentrate on the learning and practice of the rules of written reckoning for numbers, money and weights-and-measures and generally for fractions also. It is becoming more common for decimal fractions, which in Britain are not relevant to young children's lives, to be postponed, except for acquaintance with the notation, until the secondary stage.

A growing importance is given to practical work. It has a firm place in theory, but in many schools it has not yet surmounted the examination pressure mentioned above. The term " practical work " is also gaining a fuller meaning ; it embraces not only doing, but also thinking and talking about situations in which environment plays a significant part.

In the best schools, the opportunity to introduce children to mathematics incidentally in connection with other subjects is regarded as a mainspring of the work. It is leading to a much more general mathematical approach rather than the pursuit of mere reckoning. Examples of the tendency are :—

a) Simple map or model making in connection with environmental studies of a simple kind, expeditions to a farm, etc. A farm expedition may lead to a need for "long division" to satisfy an enquiry about the high costs of feeding stuffs, which then prove less overwhelming per cow than in bulk.

b) Representation leading to graphs in particular and well understood circumstances, e.g., a record of the growth of a plant over a prolonged period.

c) The recording of things which have actually been done and the reading of suggestions for carrying out enquiries, have led to much excellent practice of reading and writing together with an approach to formulation where the situation is a quantitative one.

Examination of reckoning is still an important factor in most 11+ selection examinations, and it therefore tends to loom very large in examinations internal to the schools.

AIMS

The official " Handbook of Suggestions to Teachers " was published in 1937 and is now out-of-date, though in some respects it is still in advance of common practice. It gives the teaching of mathematics in the primary school three main purposes, namely : first, to help the child to form clear ideas about certain relations of number, time and space ; secondly, to make the more useful of these ideas firm and precise in his mind through practice in the appropriate calculations ; and thirdly, to enable him to apply the resulting mechanical skill intelligently, speedily and accurately in the solution of everyday problems.

METHODS

The general suggestion in the "Primary School Report" of 1931, that the teaching of young children should be measured in terms of "activity and experience", is realised perhaps less in mathematics than in any other subject, except in nursery schools, where it is entirely incidental.

In so far as courses for teachers conducted by His Majesty's Inspectors act as suggestions for method, the general influence is to draw teachers' attention to the way in which children learn at various stages of maturation rather than to deal with details of subjects.

It is still common to find specialised apparatus for the early teaching of number, i.e., concrete material specially designed to illustrate number notation and number relationships. It is however increasingly common to find much of this being displaced by activities which stimulate real-life situations and by actual experiences.

Games are also included fairly commonly in the early stages of mathematical teaching, though it is more common to find games which encourage automatic response to simple number bonds in scoring, than those which have some genuine mathematical content.

Textbooks are not referred to in official suggestions ; they do in fact influence the majority of schools for children of seven to eleven years of age.

MISCELLANEOUS

The teaching of mathematics at the primary stage is heavily handicapped by traditions inherited from the old " all-standard " school containing children from seven to fourteen years of age, and by the use of skill in reckoning as a criterion for selection for types of secondary education. There is however a growing movement for reform in terms of a child's needs and consideration of his whole growth.

Among recent or projected reports on the teaching of mathematics in primary schools are :—

a) Arithmetic in Primary Schools: A Report on the Teaching of Arithmetic and Spatial Knowledge in Primary Schools. Prepared by the Association of Teachers in Colleges and Departments of Education. (Longmans, Green and Co., 1947.)

b) A report on the same subject is in course of preparation by a sub-committee of the Mathematical Association. It may be finished in 1950.

Scotland

From the reply sent by the Scottish Education Department

PLACE OF MATHEMATICS IN THE CURRICULUM

In the nursery school (ages 3-5 years) informal instruction in the meanings of the numbers one, two, three etc., is given through the play activities of the children. In the infant school (ages 5-7 years) a preliminary period of informal work with concrete material familiarises the child with the number names, their meaning, sequence, and written symbols and gives him the beginnings of an arithmetical vocabulary. Simple addition and subtraction are begun once number recognition is sufficiently secure.

In the infant school the length of the school day varies considerably from school to school. The informal methods of the infant room and the varied nature of the individual activities make it undesirable to lay down time allowances for this stage. Towards the end of the infant stage, however, it is expected that something like three hours per week should be given to the subject, which is called " number " or, less frequently, "arithmetic". Some of it should, of course, appear in each day's programme.

In the primary school (ages 7-12 years) the recommended time for " arithmetic " is four hours a week out of the minimum of $22^1/_2$ hours available for secular instruction. Some schools may give as much as five hours per week. Approximately the same time is given to arithmetic each day of the week. It is recommended, however, that an arithmetic lesson should not last more than thirty minutes in the younger classes, or forty-five minutes in the older classes, and that mental practice involving concentrated effort should not last more than five or ten minutes.

Geometry is not studied in the primary schools.

SYLLABUSES

The rate of progress in the *infant school* varies according to the pre-school experience of the pupils. By the age of seven years the pupil should normally be familiar with numbers and notation up to 100, be able to add two (or more) numbers provided the total is not more than 20, do the corresponding subtractions, and apply his knowledge to appropriately simple problems. He might also be able to do simple shopping sums with halfpennies, pennies and possibly with threepences or sixpences or shillings. More stress is laid on oral than on written work, and one of the aims is to secure ready and accurate knowledge of addition and subtraction facts.

In the *primary school* (ages 7-12 years) there are five stages, each of one year. No hard and fast rule is laid down as to the precise amount of ground to be covered in each of these years nor as to the precise order of topics. The schools within a county usually follow much the same programme in each of these years. The following represents an approximation to common practice :—

Primary 1 (7-8 years of age) : notation is extended to 1,000, and addition and subtraction are extended correspondingly. Five or six of the multiplication tables are taught here, i.e., multiplication of the numbers 1 to 12, by 2, by 3, and so on. The order in which these tables are taught varies. " Even " division comes along with, or very shortly after, multiplication and " uneven " division, once the multiplication and even division facts are reasonably sure. Concrete material is not used for simple addition and subtraction, unless a pupil requires its help. Some schools introduce concrete working here with, for example, halves and quarters. Simple practical work with money is continued.

Primary 2: notation is extended to 10,000 or 100,000. The remainder of the multiplication tables up to 12×12 are taught, the order varying somewhat from school to school. Normally no further multiplication tables are taught. Division continues along with multiplication. Short multiplication and later short division are taught, although short division may be postponed to near the end of the year if the class is having difficulty. Further practice with money familiarises the pupils with the table of money, and a start may be made with simple addition and subtraction. Concrete practice may be continued with simple fractions. Pupils may also begin some practical work in the use of weights and measures.

Primary 3: the four processes as applied to ordinary numbers are extended to include multiplication by two digits, and sometimes by three. Long division by two digits is begun in the latter part of the year. The table of money is dealt with thoroughly, and pupils are taught to add and subtract £. s. d., to multiply money by numbers from 2 to 12, and later in the year to divide money by these numbers. A beginning may be made with selected parts of the tables of weight, length and capacity and simple examples dealing with these. Concrete work with fractions may be extended to include ideas of the equivalence of fractions.

Primary 4: notation is extended up to 1,000,000. Practice is given in more difficult examples of long multiplication and long division. These two processes are extended to money. The tables of weight, length, capacity and time are taught and the four rules are applied to them. Whether this extends to long multiplication and long division depends on the ability of the class. A beginning is made in the application of the four rules to vulgar fractions.

Primary 5: the work on money, weights and measures is extended, and the work on vulgar fractions continued. The application of the four rules to decimal fractions is often dealt with here, but recent recommendations suggest that this might be left to the secondary school. Simple proportion is taught here.

Throughout each of the five years there should be regular revision of previous work, and constant application of the processes learned to problems within the comprehension of the particular stage.

In the early stages of the infant school (ages 5-7 years) practical work with the concrete is essential. It is also necessary when money, weights and measures are introduced. Some teachers find it helpful to have a " shop " to give practice in weighing and measuring and to lend reality to money calculations of various kinds. In general, practical work does not receive the attention which it merits. It is to be noted, however, that measurement occurs in handwork exercises, e.g., in the making of cardboard or other models, in bookcraft and in pattern design.

The promotion of pupils to secondary schools takes place between the ages of 11½ years and 12½ years. An estimate is made of the pupil's fitness for a particular course in the secondary school by considering in the first place (i) the teacher's estimate marks for the particular pupil in English and arithmetic (these marks are usually scaled by comparison with the pupil's performance in an external examination for the particular area), (ii) the marks gained by the pupil in an external examination set for the area in English (including composition) and arithmetic (including problems) and (iii) his intelligence quotient. The relative weight given to these sets of marks varies from area to area but proficiency in arithmetic is always part of the evidence considered. A final decision is not based on these figures alone but takes into account the wishes of the parent, the preferences of the child and any personal characteristics or circumstances likely to have a bearing on the child's progress.

METHODS

Various suggestions as to method are contained in the Department's memoranda on the various aspects of primary school education. Schemes of work are drawn up by each county and city for the guidance of their own schools in the preparation of their individual schemes of work. Such county and city schemes generally include recommendations as to method where it is to the advantage of the children that such methods should be uniform over the area concerned, e.g., methods of subtraction, especially of the type 52-28, order of multiplication when multiplying by two or more digits, and position of quotient in division.

Concrete material of all kinds is used in the infant school, appropriate weights and measures in the primary school. Each child in the primary classes has a graduated ruler.

In the nursery school, number is introduced through nursery rhymes, simple games, routine fetching and putting away of toys or plates or mugs or spoons. This number work is begun as soon as a child enters the infant school at the age of five, the extent, variety and usefulness of the games depending on the quality of the teacher.

No textbooks are used in nursery schools. Section II of the Education (Scotland) Act, 1946 states that " An education authority shall provide free of charge... books, writing materials, stationery, mathematical instruments... which are necessary to enable the pupils to take full advantage of the education provided. "

Textbooks are selected by headteachers in consultation, if they so desire, with their staffs. The approval of the education authority is necessary. It is not likely that the education authority will refuse to supply the textbook ordered by a headteacher unless the book is much out of date, or unless the school has already spent its allowance of money for the session. The preparation of textbooks is in the hands of the publishers who are always ready to consider suggestions for new books or for the improvement of old ones.

Activity methods have not been carried to the extent of taking the place of textbooks, being used rather as a means of initiating new work or strengthening grasp of previous work.

MISCELLANEOUS

It should be remembered that in Great Britain the system of coinage, weights and measures requires the devotion of more time to the subject than is necessary in a country using a metric system.

As a result of the recommendations of the Advisory Council in their report on the Primary School, the Department are publishing memoranda on various aspects of primary school work. A revision of schemes of work is being undertaken or is about to be undertaken in almost all counties and cities. These revisions are being undertaken partly because of the Advisory Council's report, partly because of the changes consequent on the raising of the school leaving age and its repercussions on the primary school, and partly because of the desire to bring schemes of work into closer relation with the developments of the last ten years.

Research is necessary to determine more satisfactorily than at present the best times to introduce various processes, the best methods of teaching various processes, and the best methods of diagnosing and removing difficulties.

Three recent works are publications of the Scottish Council for Research in Education: Studies in Arithmetic (1941) in two volumes; The Early Development of Number Concepts (1942): and The Teaching of Arithmetic (1943), by John MORRISON.

URUGUAY

From the reply sent by the Ministry of Education and Social Welfare

Place of Mathematics in the Curriculum

Introduction to mathematics begins in Uruguay in the infant school, with children of four or five years of age. In the primary classes, approximately five hours a week are devoted to the subject called *aritmética y geometría* (arithmetic and geometry), the study of the properties of solids beginning in the first class.

Syllabuses

The main points of the urban primary school syllabus are as follows :—

1st class: notions of unity and quantity, more and less, little and much, increase and decrease ; number facts ; concrete notions of tens, dozens and hundreds ; simple oral and written exercises on addition and subtraction ; use of the signs +, — and = ; counting upwards and downwards in two's, three's, five's and ten's, within the range 1-100 ; notions of half, third, quarter and fifth ; simple oral exercises on dividing ; one-, two- and five-centime coins, and simple buying and selling exercises ; use of the metre ; observation of the differences between the sphere, cube, cylinder and prism ; drawing planes, use of the ruler ; becoming familiar with the terms larger, less large, higher, bigger, smaller, etc.

2nd class: revision of the first year's work by means of oral and written exercises ; whole numbers up to 10,000 ; mental arithmetic on the four operations ; written addition and subtraction with checking ; multiplication by two-digit and division by one-digit numbers ; fractions up to tenths ; buying and selling exercises, using 1-, 2-, 5- and 10-centime coins and notes of 50 centimes and 1 peso ; simple problems concerning the environment ; metre, decimetre and centimetre ; litre ; kilogram and use of scales ; Roman numerals up to 50 ; clock-reading ; properties of cone and pyramid ; surfaces as limits of solids ; polygons and circles ; recognising triangles, squares and rectangles ; lines as limits of surfaces ; positions of straight lines, the plumb-line ; use of ruler and set-square ; cutting out and folding.

3rd class: whole numbers; exercises on the number facts (not insisting on numbers over seven digits); multiplication by 10, 100, 1,000, etc; completing the study of multiplication and division; checking the four operations; developing speed; reading, writing, and making graphs of fractions; comparison, addition and subtraction of fractions with the same denominator; decimals to three places, with applications to money, length and postage stamps; the four operations with decimals, multipliers and divisors being whole numbers; division by 10, 100, 1,000, etc.; practical exercises and simple problems on measures of length; multiples and sub-multiples of the litre; simple problems on the unitary method; Roman numerals up to 500; prisms and the cube as regular prism, pyramids and the tetrahedron as regular pyramid; spheres, cylinders and cones; straight and curved lines; notions of perpendiculars by means of folding; relative positions of lines and planes; use of ruler and set-square; measuring lengths; right-, acute- and obtuse-angles; the different triangles and quadrilaterals; circles and the use of the compass; simple construction exercises with folding or using ruler, set-square and compass.

4th class: oral and written revision exercises on the previous years' work; whole numbers and fractions; addition and subtraction of fractions; decimal notation, and multiplication and division with decimals; weights, and measures of length, area and capacity; exercises and problems with data provided whenever possible by the children; practical problems with money; units of time, changes of unit, and easy problems; notions of degrees, the protractor; measuring and constructing angles; different kinds of trapezia; notions of diagonal, median, perimeter, axis and centre; regular and irregular, symetrical and asymetrical figures; equal, equivalent and similar figures; base and height of triangles and parallelograms; area of parallelograms and triangles; use of ruler, set-square, compass and protractor; study of the properties of figures by means of folding.

5th class: oral and written revision exercises; notions of divisibility by 2, 3, 5 and 10; products of equal factors, square and cube of numbers; agrarian measures; weights, and measures of volume and capacity; comparison of whole numbers, decimals and fractions; the four operations with fractions and mixed numbers; the Uruguayan monetary system; simple notions of percentage and discount; invoices and receipts; classification of polygons; area of regular and irregular polygons, the trapezium being a special case; lateral and total area of polyhedral figures; graphs.

6th class: prime and non-prime numbers, powers and exponents; use of brackets; weights, and measures of length, area, volume and capacity; the metre as basis of the metric system, and its exact definition; relationships between the various metric units; reading a gas-metre ; the monetary system ; title-deeds, stamps, stamped paper, and their uses; ratio and proportion; simple and compound rule of three ; problems on proportional division ; notions of percentage, interest and discount, and exercises ; savings banks ; line, ray and segment ; relationship of circumference to diameter, and area of circles ; lateral and total surface and volume of prisms, pyramids, cylinders and cones ; temperature and pressure graphs, from data collected by the children or taken from geography, physics or other lessons.

At all levels, practical exercises should form an integral part of the lessons, and the various subjects in the curriculum should be closely articulated.

Aims

All teaching at primary level should help to develop a child's feeling with regard to love, justice, patriotism and social solidarity, and awaken his sense of beauty. Arithmetic and geometry should, in addition, give him practical knowledge.

Methods

The urban primary school curriculum contains recommendations as to method. It is deemed of special importance that teachers should make constant reference to the children's own experience ; the children themselves are asked to suggest problems or provide the numerical data for them. It is also stressed that the curriculum is no more than a guide for the teacher, which must be adapted to each new class or even each individual child.

VENEZUELA

From the reply sent by the Ministry of National Education

PLACE OF MATHEMATICS IN THE CURRICULUM

Introduction to mathematics begins in Venezuela in the infant schools, where children first go at the age of five.

In primary schools, approximately four hours a week are devoted to a subject called *cálculo y matemáticas elementales* (arithmetic and elementary mathematics). It includes notions of geometry.

SYLLABUSES

The main points covered by the primary syllabus are as follows:—

1st class: counting and reading numbers up to 100; writing numbers up to 10; addition and subtraction; counting in two's and five's; measures.

2nd class: numeration and notation (Arabic and Roman numerals); addition of one-digit numbers, totals not exceeding 36, and of two-digit numbers without carrying; subtraction of a two-digit number from a three-digit one; the metric system.

3rd class: addition and subtraction of whole numbers and sums comprising bolivars and centimes; multiplication and division of three-digit by one-digit numbers; the metric system.

4th class: addition and subtraction with quantities expressed in bolivars and centimes, metres, decimetres and centimetres, and kilograms and grams; multiplication and division with quantities expressed in these units by numbers of one, two and three digits; standard weights and measures.

5th class: the four operations with whole numbers and metric quantities (revision and further work); Arabic and Roman notation (continued); vulgar and decimal fractions; percentages; the metric system.

6th class: the four operations with whole numbers, decimals and fractions ; problems on percentages ; problems arising in home life ; proportional parts ; standard weights and measures.

In all classes, the end of every lesson is reserved for practical exercises to test and consolidate what has been learnt and to give practice in skills.

Notions of mathematics are also taught incidentally during lessons on other subjects. The ethics and civics syllabus for the fourth class is especially worthy of note in this connection, including as it does a study of the origins of money. Learning to measure is also part of the handwork syllabus for the 3rd class, and entails making a ruler, measuring areas and drawing a plan of the school.

Examinations in the primary school cover the whole of the curriculum, and all subjects are of equal importance.

AIMS

The teaching of arithmetic and elementary mathematics is expected :—

a) to give a child a sufficient knowledge of number so that he may realise the importance of arithmetic in social life ;

b) to give him accuracy and confidence in handling numbers and grasping numerical relationships ;

c) to develop in him a habit of thinking clearly ; and

d) to develop his arithmetical sense.

METHODS

One section of the syllabus is headed : *Actividades Sugeridas* (Suggested Activities). The purpose in putting them forward was to encourage teachers to make use of broad functional or practical techniques, of the kind entailed, for example, in setting children to use the list of contents of a book, count a group of pupils, buy food, draw, or compete in a group.

Each teacher, according to his individual tastes and initiative and with the help of his pupils, gathers together his own collection of teaching materials.

In regard to the question of textbooks, the general custom in Venezuela is for each child, following his teacher's instructions and using data provided by projects or " centres of interest ", to make out his own arithmetic notebook.

YUGOSLAVIA

From the reply sent by the Ministry of Education and Culture

PLACE OF MATHEMATICS IN THE CURRICULUM

Children from three to seven years of age get notions of mathematics in Yugoslavia's nursery-infant schools, but begin a systematic study of the subject called " arithmetic and geometry " only when they reach seven, in the first primary class. Six hours a week are devoted to it in the first two classes, and five hours thereafter.

SYLLABUSES

The principal items in the primary syllabus are as follows :—

1st class : the four operations within the range 1-20 ; notion of a half ; money and measures ; relationships of position, shape and dimension.

2nd class : the four operations orally and in writing ; notions of a quarter, fifth and tenth ; Roman notation up to 12 ; lines ; money and measures ; telling the time.

3rd class : the four operations with numbers up to 1,000 (two-digit multipliers, one-digit divisors) ; Roman notation up to 1,000 ; measures ; notions of geometrical solids ; surfaces, angles, corners ; the principal geometrical figures and their perimeters.

4th class : the four operations with numbers up to 10,000 (two-digit divisors) ; measures of area and volume ; exercises with compound numbers and decimals ; percentages ; the rule of three ; cubes, parallelepipeds, cylinders and spheres.

In all classes, practical exercises are given in order to test, fix and extend what has been learnt. Lessons on other subjects—natural science, geography, history, handwork—also offer opportunities of applying and confirming mathematical ideas.

There are no yearly or leaving examinations in Yugoslavian primary schools, but a child whose results in mathematics are considered unsatisfactory is not promoted.

AIMS

Arithmetic and geometry at primary level are expected help a child a) to form quantitative notions, b) to learn the mechanism of the four operations, c) to develop his sense of order and accuracy, and power to reason, and d) to acquire geometrical ideas necessary in practical life.

METHODS

The curriculum contains recommendations on method.

The subject being based on observation and the handling of objects, teaching materials are used which include various pieces of apparatus for counting (the ball-frame, the Jevric apparatus), and money, drawings and pictures.

In the nursery-infant schools and the lower primary classes, certain children's games are utilised.

In each of the constituent republics, textbooks chosen as the result of a competition have been published for all primary classes.

MISCELLANEOUS

Among recent publications on the teaching of arithmetic, the following should be noted : Milan JANJUSEVIC's " L'enseignement de la première dizaine " ; Jivoin DJORDJEVITCH's " L'enseignement du calcul à l'école primaire " ; and Stanco PRVANOVITCH's " Le calcul mental à l'école primaire et dans les petites classes des lycées ".

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